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ANEURISM OF THE AORTA TREATED BY THE INSERTION OF A PERMANENT WIRE AND GALVANISM [MOORE-CORRADI METHOD].

WITH A REPORT OF FIVE CASES.

By GUY L. HUNNER, M. D.,

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The study of the literature concerning aneurism of the aorta convinces me that this dreadful malady is usually a surgical disease. The authenticated spontaneous cures are sadly few in number. Clinical experience demonstrates that we can extend but little hope to a patient in proposing the palliative method of Bellingham[1] commonly known as the Tufnell[2] treatment. Moreover, this treatment, as well as its modification by the use of potassium iodid as proposed by Balfour,[3] to be properly carried out, requires first, a patient of more than ordinary hardihood, and secondly, conditions with which it would be impossible to surround the average patient. With these facts before us, and a surgical measure at hand with which there is considerable chance for success it may be questioned whether we are justified in allowing these cases of aortic aneurism to go without operative interference.

It is impossible in a paper of this scope to enter into the merits of the various methods of treatment now in vogue, but we may be permitted a hurried survey of the subject. We are confining our remarks to aneurism of the aorta. For those aneurisms of the vessels of smaller and intermediate size easily reached by the surgeon, it is probable that the Hunterian treatment by ligature will long continue the preferable method.

Ligation of the aorta, reported in ten cases[4] as performed for aneurism, has been universally fatal, the patients living from 4 hours to 11 days.

Pringle[5] refers to five cases of abdominal aneurism, probably all of the aorta, successfully treated by proximal pressure. Manifestly thoracic aneurisms cannot be so treated, and he recognizes the fact that most abdominal aneurisms arise about the celiac axis and cannot be treated by proximal pressure. Pringle would limit this method to those aneurisms which arise below the aortic bifurcation. He quotes results in five cases of abdominal aneurism treated by distal compression. Death followed in these cases from peritonitis, obstruction of the bowels, gangrene, and reduction of the pancreas to a pulp.

The method of Cinicelli[6] of galvano-puncture or electrolysis was first suggested independently by Velpeau[7] and by Benjamin Phillips[8] and is still being used with more or less success, principally by the Italians. Another method in vogue in Italy is that of Baccelli[9] who introduces several steel watch springs into the sac and allows them to remain.

The only other surgical method worthy of consideration is that successfully practised by Macewen,[10] of needling the inner lining of the sac and waiting for the thrombus formation

and, according to Macewen, organization. Given an aortic aneurism of small size with the three coats and their vasa vasorum, and this method offers some chances for cure. But the process requires from a few to 48 hours for the needling and from weeks to months for the thrombus formation, even in the most favorable sac. Moreover, the strengthening of the wall takes place where the point of the needle plays rather than on the anterior wall, where, in aneurism of the thoracic aorta, at least, there seems to be the most frequent extension. Manifestly in abdominal aneurism only those sacs which lie in immediate contact with the parietes could be so treated and the certain diagnosis of such a condition is quite an impossibility.

The brilliant results reported by the French [11] authors in the use of the gelatin method have not been confirmed in our wards. With Dr. Futcher [12] we believe the method deserves further trial and would recommend it if a patient presents himself before being in a desperate condition. Dr. Finney suggests that future experience may prove the advisability of giving a few gelatin injections shortly before operation by the Moore-Corradi method.

In the year 1864 Mr. Charles H. Moore of the Middlesex Hospital first attempted the cure of an aortic aneurism by the insertion of a permanent foreign body.

That this hazardous operation was undertaken only after careful consideration of the principles involved, is evidenced by his observations; to wit, "the first indispensable condition for the cure of thoracic aneurism is to provide means of eliciting fibrin from the blood," and, "the second indispensable condition for relieving an aortic aneurism is to extend the surface within it on which fibrin may coagulate."

Nothing daunted by a failure in his first case, due to the then obscure agent sepsis, he says:—"if there be no manifest and essential fault in the procedure I cannot think it right to abandon an operation which was so promptly followed by the most marked and positive improvement. On the contrary, I regard its early results as strikingly confirming the main part of the theory and as affording for other cases a substantial promise of advantage from which future thought has but to eliminate the cause of ill success." And he suggested two very important improvements in technique; (1) that a less quantity of wire be used (he used 78 feet) and (2) that the wire be so manipulated as to insure its coiling in the cavity and not merely lying in circles against the walls.

Since Moore's failure the application of aseptic surgery has removed the greatest "cause of ill success" and the addition of electrolysis as suggested by Corradi has been a marked improvement in method.

Method.—While this operation was devised by an Englishman and modified by an Italian, it has been developed principally by Americans. And among these Dr. D. D. Stewart, of Philadelphia, deserves most credit for his activity in evolving a good technique.

In his preparation for an operation the surgeon should experiment beforehand with his needles, wire, and electrical apparatus, to find which he can manage with the greatest facility and effectiveness. The needles should be considered with regard to size, material, insulation and sterilization. One chooses between the cannula with trocar, and the lance-pointed aspirator needle, which latter may be inserted alone or with the initial end of the wire already introduced. Within limits the needle should be large enough for the easy passage of the wire. The loss of blood, if the wire be inserted with the needle, or soon after, is very slight and most aneurism patients would probably be benefited by some bleeding.

As to insulation, the needle should be covered from the shoulder to within 1 cm. of the point, with some non-conducting material, so that the electrical current will not be dissipated when the needle passes through the sac wall. Duncan [13] after trying glass, sealing-wax, varnish of various kinds, caoutchouc, and shellac, advised covering the needle with vulcanite; but hard rubber cannot be properly used without materially increasing the caliber of the needle. Our needles were covered neatly and effectively with a black varnish or lacquer. ("Best French Lacquer," made by Behlen & Bro., New York City.) This cannot be boiled nor will it bear soaking in carbolic. It softens in the steam sterilizer either with or without pressure but quickly hardens on exposure to dry air; so this method may be used. But the best method is to sterilize in a dry-air chamber. One should select a half-dozen needles of various sizes and lengths; have them lacquered; place them in a test-tube, and cork with cotton. This is placed in a hot-air chamber, the temperature raised to 160 degrees C., and allowed to remain there one hour. The test-tube is kept corked until time for the operation, when the needles are emptied out on a dry sterile towel or plate.

In selecting wire one considers the amount to be used, its size and its composition. The recognition of a few general principles will aid in its selection. (1) The disposition of the wire in the lumen of the sac is an important factor in the amount and effectiveness of the fibrin whipped out. A small quantity of fine wire possessing a good spring should be selected. (2) Cure of the aneurism demands as complete contraction as possible of the sac wall upon the clot formed at or soon after the operation. The wire should be of such amount and material as not to interfere seriously with this contraction. (3) The corrosion of the wire by the electric current makes a rough surface very conducive to the rapid whipping out of fibrin. Within limits the wire most easily corroded is to be preferred.

One can gain many valuable points regarding wire and needles, and acquire a facility in their management by experimenting on a few glass flasks varying in capacity from 200 to 500 cc. and stoppered with ordinary corks. The needle is pushed through the cork, and the wire, after being wound on a spool and boiled as described in Finney's first case, is passed into the flask. It will be found that 10 feet of fine wire with a lively spring, effectually meshes the lumen of a 500 cc. flask. By reference to the literature we find that no more than 10 feet of wire were used in the successful cases. But we believe 20 feet might be used in some cases and Dr. Stewart is of the same opinion (see report of his fourth case).

Steel wire takes a better coil than pure silver, even after the latter is highly drawn. But steel is stiff for manipulation, has a high resistance, and, theoretically at least, would interfere with the contraction of the sac. Soft iron wire, as shown by the experiments of Stevenson,[4] decomposes very rapidly under the electric current and, as demonstrated by Stewart, it is probable that the detritus given off would be a source of danger in the capillary circulation. The undrawn silver has scarcely any tendency to coil after passing the needle, and either jams from side to side as it meets the resistant glass walls, thus only partially getting into the lumen, or takes the broadest coil possible about the periphery. We have not worked with gold wire as used by Stewart and others.

After considerable experimenting in conjunction with Mr. Frank Persohn, who makes the wire used in the hospital surgical work, we found a silver alloy, highly drawn, to be quite ideal;[1] 75 parts of copper to the thousand makes a wire which when drawn from No. 8 to No. 27 (standard gage) takes a closer coil than steel (see photograph). It is more pliant than steel, thus minimizing the danger of puncture should the end come in contact with the thin aneurismal wall. It has more body than the pure silver of equal drawing, and is therefore more easily passed into the needle without kinking. It corrodes much more than steel, thus forming a rougher surface for the whipping out of fibrin. We believe, however, that the fibrin formation is far more a chemical than a mechanical process; and silver, being one of the least resistant of all metals to the electric current, transmits more of a given current for action on the blood.

With regard to electrical appartus we have found the galvanic battery of the Baltimore Chlorid of Silver Dry Cell Battery Company a compact, simple and effective instrument. It rests on a small table near the anæsthetist and by means of its insulated conducting cords is connected—the positive pole to a long end of the wire from the aneurismal sac, the negative pole to a metal plate at the back. This plate should be well covered with several layers of towel kept moist throughout the operation.

Never should the sac receive both poles, nor should the current be so passed that the negative electrode is in the sac. Duncan, and later Stevenson, in the papers above cited have shown that about the negative pole there accumulates "a yellow, friable, alkaline, mass composed to a great extent of gas bubbles which very quickly break down." While about the positive pole "the clot is smaller, firmer, and darker in color, and has an acid reaction."

Abbe by reversing the current toward the close of his operation probably softened the clot already formed by the positive current.

Experiments.—We wish to supplement these remarks on method with the results of a few experiments made with the view to determine the effects of the electrical current on different wires and on the blood. Taking to the abattoir two batteries and both steel and silver wire we had fresh hog's blood caught in two glass jars which had been thoroughly cleaned and vaselined. We were surprised at the almost instantaneous coagulation of the blood, but in spite of this phenomenon we had no difficulty in placing our wires. A coil to receive the positive current was pushed down into the center of the jelly-like mass, and the negative wire was carried to the bottom of the jar through a fine glass tube inserted at the periphery of the clot.

The batteries being connected, a current of 100 ma. was passed through each clot. The current through the steel wire remained practically constant for an hour, while towards the end of this time that through the silver wire grew less, as explained below. The action of the powerful current was immediately manifested about the negative wires where their ends projected from the glass tubing. Here there was a rapid formation of water, an active ebullition of gas bubbles, and finally a large excavation in the bottom of each clot.

At the end of an hour the rolls of coagula were slipped out of the jars and the wire coils examined. These showed a marked action of the positive current. The steel wire was surrounded throughout its length by a zone of adherent blackened material three or four millimeters in width. The wire was corroded and of slightly smaller caliber but still retained its form and resistant spring. The silver wire presented a more decided picture. The charred coagulum about the wire was of greater width than that about the steel wire, and the wire itself had suffered such corrosion that it broke easily in attempting to free the clot. We wondered why the galvanometer registering for the silver wire should drop during the last quarter hour from 100 to 50 ma., and here was the explanation in the reduced caliber of the wire.

To test the coagulating power of the electrical current we decided to try partial tying off of a dog's aorta at two different points, hoping thereby to get a slowing of the current and some dilatation between the points of partial ligature. Partial tying at the bifurcation did not cause appreciable dilatation above, nor was a sac imitated when another partial ligature was placed just below the renal arteries. The latter ligature was discarded and the lower ligature tightened to entirely close the lumen at the bifurcation. This caused an appreciable increase in tension and possibly some dilatation. A strong current was flowing because of the renal, ovarian, and numerous small lumbar arteries.

An insulated needle was inserted just above the ligature with its point toward the dog's heart and a number 5 (music gauge) steel wire easily inserted. The wire quickly perforated and we had to withdraw the needle and tie off above the perforation. We then loaded the needle to its point with a pure silver wire (drawn), of the same size (No. 27 standard gauge), and inserted the needle to its hilt. This carried the wire above the renal arteries where it was left by simply slipping the needle back to its point of entrance. With the positive pole connected with this wire and the negative to a large metal plate under the dog's shoulders a current of 50 ma. was

[1] This work was done immediately after Dr. Halsted's case in the winter of '97-'98. Reeve shortly afterward experimented with various kinds of wire and arrived at the same conclusion with regard to the propriety of the siver alloy.

passed for ten minutes, then a current of 65 ma. for ten minutes, increasing to 80 ma. and keeping it there for twenty minutes. At the end of this 40 minutes the wire could be felt distinctly larger. The current was stopped and the dog quickly killed with the anæsthetic. On dissecting out the aorta from the diaphragm to the bifurcation and opening it the wire was found to be covered by a coating of reddish yellow fibrin, varying from 1-2 mm. in thickness. This was rather firmly adherent to the wire, coming off in strings when pulled away. The wire was considerably corroded, fine bits of silver coming off with the fibrin and more being scraped off with the finger nail.

Being convinced by various observations that the current generally used is stronger than necessary and even dangerous (see autopsy report, Dr. Finney's first case) I tried in a dog's aorta the effect of a 20 ma. current for an hour. This caused apparently the same amount of coagulum as described in the foregoing experiment, but possibly the fibrin was not as firm as that formed by the stronger current. The wire was blackened and slightly corroded. On another dog 10 ma. were passed for one hour with similar results. In the case of a wire left in the aorta for an hour with no galvanism the wire collected no fibrin.

In order to observe more carefully the effect of different currents upon the aortic wall, two dogs were prepared as above, and currents of respectively 100 ma. and 20 ma. were passed for an hour. Both wires collected about the same quantity of fibrin. The aortic wall subjected to the stronger current showed decided destruction of tissue wherever the wire came in contact with it, while that of the weaker current was merely discolored in similar situations.

We shall dwell but briefly upon the operation itself as the points are covered more thoroughly in our report of cases. In thoracic aneurism one of the greatest claims of this method over that of distal ligation is the fact that the patient does not require an anæsthetic.[2] This is particularly advantageous in cases of dyspnœa and bronchitis from pressure on the trachea. Locally cocaine or ethyl chlorid may be used. Usually the needle is inserted where the sac wall seems nearest the exterior surface. If there be more than one point of bulging and it be suspected that a multilocular or very large sac is being dealt with it would be advisable as suggested by Stewart to pass wires at more than one point and attach the positive pole to each. The needle should be inserted as nearly as possible with the direction of the entering current and away from the mouth of the sac. If a kink occur after some wire is in, one inserts another needle and after passing the required amount of wire both wires are attached to the positive pole.

For the abdominal cases make the usual preparations for celiotomy. Be particularly careful to clear the intestines in order to have the field of operation as free as possible. The method of exposure of the sac will have to be determined for the different organs, the adhesions present, the direction in each case according to the position of the sac, its relations to which the needle should be passed and other contingencies that arise after opening the peritoneal cavity.

We present below a brief summary of all cases treated both by Moore's method of wire alone, and by the method of Corradi in which electrolysis was used.

[2] Reeve used Schleich's solution for his case, and Dr. Finney wired an abdominal case October 19, 1900, using the same anæsthesia.

Abstract of the Cases Treated by the Wire (Moore's) Method.

Case I.—Moore: 1864. Medico-Chirurgical Transactions (Lond.), Vol. XLVII, p. 129.

Man; aged 27. Aneurism of the ascending aorta. Connected with this by openings in second and third interspaces, an extra thoracic aneurism of large size, increasing and threatening to burst.

***Operation.*—Twenty-six yards fine iron wire introduced through canula and pushed entirely in by blunt trocar; one hour; no pain; a slight and transient feeling of faintness; not over one-half ounce of blood lost.**

***Effect.*—Pulse reduced from 116 to 92, almost complete cessation of pulsation, and a diminution in size of tumor. Nine hours later patient asleep and pulse 78. On the next day the patient was seized with rigors and high fever, and died the fifth day with symptoms of sepsis.**

***Autopsy.*—"Interior of tumor filled, for the most part, with a fibrinous coagulum, enveloping and embedded in the coils of wire, and firmly adherent to the surrounding walls."**

Case II.—Domville: 1871. Lancet (Lond.), Vol. III, p. 287.

Man; aged 40; a private in the Royal Marines, employed as a shoemaker. Two pulsating tumors of the size of half-oranges, projecting two and one-half inches from the chest, one on either side of sternum, about on level with nipple-line. Three months' treatment by iron, sedatives and iodid of potassium pushed to iodism. Tumor increased and "rupture became imminent."

***Operation.*—Fourteen inches fine iron wire passed through canula into tumor from left side, wire being passed until resistance was felt.**

***Effect.*—At first seemed decidedly beneficial, the tumor becoming firmer and the impulse and discoloration less; but five days later the bulging again increased and the sac thinned so greatly in two weeks that oozing began from the site of puncture, and the patient died one month after operation from rupture and sudden profuse hæmorrhage from the sac.**

***Autopsy* revealed a fusiform dilatation of the whole arch; and arising from this, at a point two inches above the valves, a large sacular dilatation. Springing from this large sac was a second but smaller sac which had eroded the sternum on the left and formed the visible pulsating tumor. The wire was found coiled in the form of a figure eight, lying imbedded in coagulum on the bottom of this outer sac.**

Case III.—Murray: 1872. British Medical Journal, 1872, Vol. I, p. 596.

Thoracic aneurism, first treated by needling, then by the insertion of catgut, and finally by Moore's method, 24 feet of wire being inserted. Patient died in three weeks.

Case IV.—Rubio: 1874. British Medical Journal, 1886, Vol. I, p. 395.

Case of innominate aneurism; treated by 8 feet of iron wire; showed no change of symptoms during the first four days; was then lost sight of; presumed to have died.

Case V.—Loreta: 1885. Memoirs "Royal Academy" Bologna, Vol. 6, Series IV; Abstract British Medical Journal, 1885, Vol. I, pp. 745 and 955.

Sailor; aged 30; syphilis 5 years before. Large abdominal aneurism filling epigastrium and left hypochondrium.

Laparotomy.—Six feet fine silvered copper wire through a fine trocar. Rapid, progressive recovering. Patient passed a good night after the operation, the first in two months. Pulsation diminished same night, and the femoral pulse, before almost suppressed, reappeared. Left hospital, well, ten weeks after operation with walnut-sized hard mass in place of the large pulsating sac.

Died thirteen weeks after operation from rupture of aorta at inferior angle of junction of sac with aorta.

CASE VI.—Cayley: 1886. Medico-Chirurgical Transactions (London), Vol. LXIX, p. 267.

Sailor; aged 48. Rheumatic gout; alcoholic; syphilis 27 years before. A hen's-egg-sized, oval, elastic, pulsating tumor rising three inches into neck above right sterno-clavicular articulation. Tracheal pressure symptoms. Rigid Tufnell's diet, rest, iodid of potassium. Aneurism threatening to burst; Mr. Hulke passed 40 feet fine steel wire, resulting in complete consolidation of external portion. Exterior of tumor backward and to left, threatening death by pressure on trachea. Six weeks later Mr. Gould passed 35 feet of wire into tumor which had appeared in the left sternoclavicular region. No improvement; death nine days later from dyspnœa, due to tracheal pressure.

Autopsy revealed very large aneurism arising by large opening from a dilated ascending arch. The wires from both operations were imbedded in firm pinkish clot and separated from the main blood stream and the red post-mortem clot by a layer of firm decolorized fibrin. The opening from the aorta into the aneurism was so large that the lower portion of the sac still received a strong blood current and made the fatal pressure on trachea.

CASE VII. Lange: 1886. Medical News (Phila.), Vol. XLIX, p. 582. See also New York Medical News, Nov. 21, 1886.

An abdominal aneurism upon which Lange proposed imitating Loreta's procedure; but, there being evidence of rupture of the aneurism, Lange passed 9 feet of thin wire without laparotomy. This probably caused a shunting of more blood through the bleeding portion of the sac, for in a few days a large pulsating area appeared in the right lumbar region. Twenty-four feet of wire were passed into the pulsating area. Death twelve days after operation, from pneumonia.

Autopsy.—A double fist-sized aneurism, situated just below diaphragm, communicating with the aorta through a lengthy opening on the posterior side of this vessel. The walls of the sac were quite firm from organized fibrin. The sac was ruptured on the right side. The original sac contained an immense clot about the wire. The wire introduced into the second pulsating area, or that in the lumbar region, was quite free from clot.

CASE VIII.—Ransohoff: 1886. Medical News (Phila.), Vol. XLVIII, p. 597.

Colored man; aged 35. Moderate drinker. Admits having had chancroids, but denies syphilis. A fist-sized, pulsating conical swelling, occupying second and third right interspaces. Slight exertion often followed by severe paroxysms of dyspnœa that threaten to terminate life. Dyspnœa and œdema of right shoulder region make anæsthetic and distal deligation impracticable.

Operation.—Eight feet flexible silver wire passed through canula; syncope after 4 feet had passed. Great amelioration of all symptoms; two weeks later patient became worse; sternal side of tumor increased in size; 8 feet of wire into this portion; death one month after first operation.

Autopsy.—Aneurism of ascending portion of arch, anterior surface; dimensions, 7 x 4 inches; mouth of sac an inch in diameter. Aneurism ruptured on posterior lateral wall into right pleural cavity. Wire covered by recent coagulum. One loop had passed through the aortic opening and rested just above, and in close relation to one of the leaflets of the aortic valves. Hence the syncope during the first operation.

CASE IX.—Morse: 1887. Pacific Medical and Surgical Journal, Feb., 1887; Abstract in Medical News, Phila., March, 1887.

American; aged 32. No history of syphilis or alcoholism. History of traumatism. Improved on rest, diet and iodid of potassium. Returned to work after three weeks' treatment. After three months, returned with "all signs of an abdominal aneurism."

Operation.—Laparotomy; aneurism double first size; five and one-half feet, one-half millimeter, silver-plated, copper wire passed through a needle one millimeter in diameter. After operation patient suffered several days from vomiting, but temperature never rose above 101°. Rapid recovery, patient leaving hospital eight weeks after operation feeling perfectly well. Tumor, on dismissal of patient, consisted of a hard nodule, one-half the size of original tumor, with only communicated pulsation and no bruit.

The wife of the late Dr. Morse writes that this patient lived in good health four years, doing the heaviest kind of work as stevedore. Then, after a prolonged debauch and a kick in the abdomen by a companion, he had a spell of uncontrollable vomiting, during which he died from hæmorrhage.

CASE X.—Pringle and Morris: 1887. Medico-Chirurgical Transactions, London, LXX, 261.

German tailor; aged 46; history syphilis. A visible, pulsating, expansile tumor of the abdomen. Signs of erosion of the vertebræ.

Treatment.—Rest in bed, Tufnell's diet, potassium iodid, morphia. Aneurism increased and "patient's strength at a low ebb."

Operation.—Laparotomy; exposure of sac; trocar and cannula introduced downward and to the left; after one foot of steel wire had been passed a kink occurred, and wire was cut off and end pushed in. Patient died fifth day from asthenia; highest temperature had been 100.6°.

Autopsy.—Localized recent peritonitis in operative region. Aneurism arises from posterior part of aorta and to the left, opposite the origin of the celiac axis and sup. mes. ar. Opening oval, measuring one inch vertically by five-eighths of an inch transversely. Ante-mortem clot found throughout the sac, being greater on the left side, where, by means of the galvanometer and poles of a battery, the wire was located. The wire had obviously fallen from its point of introduction and lay embedded in this portion of the sac.

CASE XI.—White and Gould: 1887. Medico-Chirurgical Transactions, London, LXX, p. 277.

A smith; aged 48; denies syphilis. Swelling of right chest noticed for five months; for two months a severe cough; dark thick expectoration; pain in the swelling.

Treatment for six weeks by rest, restricted diet and iodid of potassium, with no results. Swelling rapidly increasing in size and threatening death by rupture.

Operation.—Cocaine; Southey's trocar into third intercostal space at spot where pulsation seemed most superficial. After passing 9 or 10 feet of fine steel wire it broke, and a second canula was introduced and 22 feet were introduced through it. Patient became faint but did not complain of pain. Death, ninth day, after more or less constant oozing of blood-stained serum through the site of operation.

Autopsy.—Fusiform aneurism of ascending arch, and from this, communicating by a large opening, arose a cocoanut-sized saccu-

lar aneurism. From this arose an extrathoracic portion with no definite sac wall, but being limited by a soft, shreddy, muscular tissue, abundantly infiltrated with blood and serum.

The external portion and the saccular aneurism contained a confused mass of steel wire, in the meshes of which, and surrounding which, was a considerable quantity of firm red fibrinous clot.

The mouth of the sacculated portion entering the aorta was very large, admitting four fingers; through this had extended a loop of wire into the fusiform dilatation of the arch.

This was an unfavorable case because of its rupture before operation and advance into the softer extrathoracic tissues. The fatal termination was due to the sloughing of the tissues over the aneurism, hastened by a pad over the oozing tissues pressing through on the unyielding mass of wire beneath.

Case XII.—Hulke: 1887. Medico-Chirurgical Transactions, London, LXX, p. 289.

Seaman; aged 31; heavy work; denies syphilis.

Diagnosis.—Aneurism of innominate and aorta.

Treatment.—Severe Tufnell plan.

Improved and left hospital.

Returned about five months later in a desperate condition.

Operation same day: Ether; 10 to 11 yards pianoforte wire introduced through a small canula. Felt better several days; aneurism decidedly firmer; on fifth day oozing began just above site of puncture from a crack in cuticle; aneurism began to enlarge; on twelfth day oozing from side of aneurism at a distance from site of puncture. Difficulty of breathing increased; died after 13 days, apparently from exhaustion.

Autopsy.—Aneurism of first part of subclavian. The wire, covered with a considerable layer of white fibrin, filled all parts of the sac except the upper. It was this portion which continued to expand, and from which the oozing took place.

Case XIII.—Stevenson: 1895. Lancet, London, Vol. I, p. 22.

Gunner in English army; aged 25; denies syphilis. A tumor with all characteristics of an aneurism, two inches below the costal margin and three inches to left of median line; size of a large orange; movable as patient moved from side to side.

Treatment.—Tufnell's diet, iodid of potassium, absolute rest in bed; also at suggestion of Professor Wright, calcium chlorid and inhalation of carbon dioxid gas. Coagulability of blood considerably increased, but no change apparent in tumor after three months.

Operation.—Laparotomy; transverse colon and omentum pushed up; many adhesions being broken. Two yards of finest steel wire introduced, the last end being pushed through canula by blunt knitting-needle. No bleeding on withdrawal of canula; but that evening there was a severe hæmorrhage from lower end of wound, corresponding to the site of trocar puncture through the sac. This hæmorrhage reduced the condition of patient and he died 27 hours after operation and 11 hours after bleeding had ceased, probably from syncope on attempting to sit up in bed.

Autopsy showed sac to arise from proximal end of superior mesenteric artery and to involve the anterior wall of the aorta. "Sac completely filled by coagulum and silver wire."

Case XIV.—Langton: 1899. Brit. Med. Jour., Vol. I, p. 791.

A woman gave birth to a child three months before admission to the hospital. Since labor she had noticed an abdominal swelling; and, on admission, there was a pulsating tumor in the epigastrium, three and one-half inches in diameter, movable laterally, but not vertically, and over it was a loud systolic murmur. In April, 1898, the swelling being on the increase and the pain intense, an exploratory laparotomy was performed, and the tumor found to be an aneurism of the upper part of the abdominal aorta. A trocar and cannula were introduced and an attempt was made to pass salmon-gut into the sac. This proving difficult, 5 feet of silver wire were passed with ease.

Careful examination a month later gave evidence of consolidation. At the time of the report, March, 1899, there was "a hard mass in the middle line much smaller than before the operation, and the thrill and bruit had disappeared. Her health was excellent."

Abstract of the Cases Treated by Passing Electricity Through a Permanent Wire. Moore-Corradi Method.

Case I.—Burresi (Corradi): Lo Sperimentale, April, 1879, p. 445. See later account by Marcacci: Giornale Internazionalle delle Scienze Mediche, 1881, p. 1109.

Man; aged 43. Large aneurism of ascending portion of arch of aorta. Considered a hopeless case because of thin wall and rapid expansion. Medical treatment of no avail. Corradi inserted a canulated needle into second intercostal space, directing the point away from the probable site of opening from the aorta. Forty-two cm. (17 inches) of No. 30 annealed wire were passed, the needle being constantly circumducted with the object of giving the wire a coil as it entered the lumen. The needle being withdrawn, the end of the wire was connected with the anode of a galvanic battery of 16 elements, tested by a voltameter to yield 1 cc. of hydrogen gas for the first minute. Cathode to chest-wall. Current passed for 25 minutes. At the end of the first 15 minutes of its application all pulsation had disappeared except that communicated.

Operation well borne. Pain entirely gone at end of third day. Patient continued to do well for a time, but subsequently all symptoms returned and he died 3¼ months after operation. No autopsy.

Case II.—Barwell: 1886. British Medical Journal, Vol. 2, page 675.

Man; aged 39; syphilis 20 years before, secondary symptoms for eight years; thoracic aneurism; a visible pulsating tumor from first to third costal cartilage on left side.

Treatment.—Rest and diet for seven months; at first improved, only to become worse.

Operation.—About ten feet of the finest steel wire through a hollow needle of ivory; this wire connected with the positive pole of a battery, the negative being applied by means of a large pad of spongio-piline to the back. A current equal to nine or ten milliamperes passed for one hour and ten minutes, the man feeling no pain or inconvenience. No change in tumor during operation, but at end of twelve hours patient appeared very much improved, the tumor more solid, the pulsation more distant.

Four days after operation a tumor appeared to right side of sternum, which the patient said had existed there two years previously. The man died a week after the operation from rupture of the new right sac into the right pleura.

Autopsy.—"The wide coils of wire are surrounded by thick, firm, colorless clot, which in many places binds the wire to the sac-walls, thus strengthening them and rendering rupture hardly possible wherever the wire had penetrated. This had not occurred in the secondary sac."

Case III.—Roosevelt: 1887. Medical News, Vol. L, 398.

Man; aged 25. Syphilitic history. Thoracic aneurism on the right, involving the four upper ribs near the sternum. Rest and potassium iodid two weeks; tumor increased, and case became utterly hopeless.

Operation.—No anæsthetic; a short insulated aspirator needle into tumor; 225 feet fine (No. 00) steel piano-wire passed in; about 25 milliamperes passed for one-half hour without pain.

Next day tumor pulsated less strongly. "By the tenth day

tumor was much less painful, the pulsation visibly diminished, and he could breathe easily lying on his back or left side, which he formerly could not do." During third week he could swallow and breathe with greater ease, and the tumor felt harder. On the 21st day he began to vomit and complain of headache. On 22d day a painful dark-colored spot appeared on one toe and the man appeared bad. Death on 23d day; no autopsy.

CASE IV.—Abbe: 1887. Medical News, Vol. L, p. 397.

Man; aged 46. Thoracic aneurism filling right supraclavicular space.

Operation.—One hundred feet No. 1 catgut passed into sac; outer one-third of sac became harder but the remainder continued to increase. Nine days later, 150 feet of fine steel wire passed through an insulated aspirator needle; a large copper plate, covered with wet cotton, placed at back.

Current of 50 milliamperes passed one-half hour; then 100 milliamperes for same time. Then, with the negative pole connected with the wire and the positive with the plate, a current of 100 ma. was passed in the reverse direction. Patient rather exhilarated than otherwise. Tumor still pulsating at conclusion. Death 2d day from rupture of sac into trachea. No autopsy.

CASE V.—Kerr: 1889. Occidental Medical Times, January.

A Greek; aged 38; syphilis.

Diagnosis.—Aneurism of ascending arch.

Treatment.—Rest in bed, on low diet and potassium iodid for three months; no improvement.

Operation.—Six feet drawn silver wire introduced through a medium-sized hypodermic needle covered with shellac; positive pole connected with wire, negative pole with tin plate over epigastrium; current, strength not stated, passed for 50 minutes. Relief from pain and diminution of pulsation, but on ninth day patient complained of a pressure behind sternum; on twelfth day pulsation well marked in suprasternal notch, and on eighteenth day patient died.

Autopsy.—Fusiform aneurism extending from base of heart to origin of left subclavian. "The wire entered the anterior surface of the sac; and around it, as well as on the walls, a firm clot was formed."

CASE VI.—Kerr: 1889. Occidental Medical Times, January.

Man; aged 56. Duration, 10 months; had been unable to work for 3 months past. On admission a pulsating tumor found on right side of sternum, extending to right mammary line and from second to fourth intercostal space.

Treatment.—Rest and potassium iodid two months—no improvement; electrolysis through two needles—no improvement.

Operation.—Ten feet drawn silver wire inserted, using the same method as with his first case. During the half-hour of electrolysis the pulse was very small and rapid, and there was distress and dyspnœa, but no pain. For a month he had slight burning and pain over the aneurism; these disappeared and the pulsation diminished in area and force. At the end of two months the patient left the hospital, saying he "felt as well as ever."

Dr. Kerr writes me that he knew the patient to be working as a street-paver for 10 months after discharge, and then lost trace of him, although the patient promised to send for him or reenter hospital should he again be troubled.

CASE VII.—Rosenstirn: 1891. American Journal of the Medical Sciences, N. S., Vol. CI, p. 55.

Member of the victorious Harvard crew of '83; aged 25; weight 260. "He loved wine, women and song—the two former most." Consulted Dr. Rosenstirn first in 1888 with palpitation of heart and slight dyspnœa. Later a distinct pulsating tumor found occupying second and third intercostal spaces in the right parasternal line. Absolute rest in bed, low liquid diet, cautious massage of extremities, large doses of potassium iodid. Three months gave no apparent benefit. In January, 1889, electrolysis through two needles on two different occasions; effect nil; symptoms grew worse; desperate condition.

Operation.—Twenty-six inches of spirally wound, moderately thick, softened silver wire passed through an explorative trocar and the end pushed entirely in. Then a current of 70 milliamperes passed through the trocar for thirty minutes. Patient bore operation remarkably well. After a few days pain began to subside, and after two weeks the breathing became easy and he had no more attacks of suffocation. In two months the pulsation entirely disappeared and patient was finally in most excellent health.

A letter from Dr. Rosenstirn says his patient now weighs about 280 lbs., is in good health, and leading an active life as captain or colonel of one of the volunteer regiments stationed on the Pacific coast.

CASE VIII.—Stewart: 1892. American Journal Medical Sciences, Vol. CIV, p. 422.

Insurance agent; aged 30; fond of wrestling. First examined in July, 1888; a small, expansile, pulsating swelling to the left of the upper lumbar vertebræ. Improved under three months' treatment by rest and potassium iodid, and went to work. In September, 1891, had been in bed two months with pain and prostration. Now a very large lumbar aneurism, having three large bosses, which in places seemed very thin. Signs of spinal-cord involvement.

Operation.—Two and one-half feet rather heavy silver wire (No. 23, Brown & Sharp gauge), coiled for spiral arrangement, passed through an insulated (shellac) steel needle. Current gradually increased until 70 milliamperes were reached and this strength maintained for one hour. The negative electrode was a very large felt-covered plate, which lay upon the right shoulder and scapula. Patient showed evident improvement for a few days, but pain grew worse, and on the ninth day, after thumping the aneurism with his fist, he had a gush of blood from mouth and died.

Autopsy.—An aneurism of immense size, filling hypochondrium and a part of the lumbar region. It had evidently arisen from the posterior and left lateral wall of the thoracic aorta and subsequently involved a portion of the abdominal aorta. The site of rupture was in the upper left portion, where the sac wall and laminated clot had been penetrated. A large sinus plowed into the lung. The highest coil of wire was two and one-half inches distant from the point of rupture. Firm clots in all portions of aneurism with soft clots of recent origin. The wire engaged in several large firm clots of so solid a texture that they were separated from the sac and wire only with some difficulty. The rupture was probably due to failure of wire to reach all parts of the large sac and consequent increase of pressure on a portion that had not yet been strengthened by fibrin formation. Stewart regrets not having used more wire.

CASE IX.—Stewart: 1896. American Journal of the Medical Sciences, Vol. CXII, p. 170. Autopsy; British Medical Journal, August, 1897, p. 387.

Man; aged 40; vagrant habits; syphilis in 1881; evidences of aortic and mitral disease; much albumin in urine. Large aneurism right chest; put on Tufnell's treatment and potassium iodid; aneurism increased in size, became very thin-walled; rupture seemed imminent. Refused interference by deligation.

Operation.—Conjoint use of the wire method and of galvano puncture by means of several platinum needles connected with the same rheophore as the wire, hoping thus better to secure an extensive coagulum from wire to needles and to sac wall. Two platinum needles good caliber, insulated to within an inch of the end, first introduced toward periphery of sac. Ten feet of fine gold wire, drawn hard to No. 30 gauge, played into sac;

positive pole connected with wire; negative pole, a large clay plate, placed upon the abdomen; current gradually increased to 80 milliamperes and there kept for one hour.

Before end of session much less marked pulsation in sac; needles moved about with difficulty; procedure well borne; no pain felt at any time during operation or subsequently, and no evidence of shock.

Four weeks later, it being considered that only the lower part of the sac was filled by clot, another attempt was made to enter wire into upper portion of the sac, and this was found to be filled by coagulum.

Patient lived nearly three and one-half years after operation and "died as the result of the formation of a large thrombus in the middle cerebral artery, the result of the advanced endarteritis present."

Autopsy.—The aneurismal sac springs directly from the root of the innominate artery; approximately the size of a fetal head at term; completely consolidated with organized coagula, in which lie the coils of wire.

Case X.—Hershey: 1896. The Therapeutic Gazette, Vol. XX, p. 590.

Man; large aneurism right chest, probably sacculated innominate aneurism.

Treatment.—Rest in bed, diet, barium chlorid. At end of 7 weeks symptoms all exaggerated.

Operation.—Two and one-half feet gold wire, hard drawn to No. 28 gauge, passed through hypodermic needle insulated with gum shellac. Usual method of galvanism with indicator kept at 70 milliamperes for an hour. "The needle, at first moving freely with each heart beat, became fixed; and instead of the soft, full, pulsating mass characteristic of an aneurism, was felt a hard resisting tumor much smaller."

Patient slept on back that night for the first time in 7 weeks. After 2 months, returned to work, and 9½ months later, at time of report, the patient was well and at work as a mining prospector.

Dr. Hershey writes me that one year after operation the symptoms began again, and the patient died 14 months after operation from rupture of the sac. No autopsy.

Case XI.—Stewart: 1898. Phila. Med. Jour, Nov. 12.

Day laborer; aged 40; entered Episcopal Hospital because of a pulsating tumor in the upper left quadrant of the abdomen. Patient had had syphilis; possessed sclerosed arteries; urine indicative of Bright's disease.

Diagnosis lay between aneurism of the splenic artery and a pulsating abdominal tumor. Section disclosed what appeared to be a sacciform aneurism springing from the left of the aorta at the situation of the celiac axis."

Ten feet of fine silver wire were inserted and a current of 50 ma. passed by the anode for a half-hour.

Patient died suddenly the fifth day. Examination of abdominal contents through the wound revealed a large retroperitoneal tumor almost encircling the aorta, causing a marked fusiform dilatation extending even above the diaphragm. Continuous with this fusiform widening there was a small sacciform aneurism of what appeared to be the splenic artery.

The wire had been passed through a portion of the tumor into the sacciform aneurism and thence into the dilated aorta. No clot was found on the wire within the aorta, and no mention is made of any wire stopping in the saccular aneurism.

Death was caused by hæmorrhage into the stomach, but its origin could not be determined.

Case XII.—Stewart: 1898. Phila. Med. Jour., Nov. 12.

A railroad engineer; aged 42 years; history of syphilis; an extremely large thoracic aneurism of the transverse and descending portion of the arch. Bad aortic and mitral disease. Constant intense pain, requiring the use of large doses of morphia.

Operation.—Fourteen feet of spirally wound fine gold wire were introduced at the more prominent part of the aneurism through two insulated needles. The terminal ends of the wire from these were connected with the anode and the current rather rapidly raised to 80 ma.; the electrolysis occupying 1 hour and 20 minutes. After the operation "the aneurismal swelling was decidedly less prominent, much less to-and-fro pulsation; bruit over mass not so apparent, and much less pain complained of." For periods the pain disappeared altogether. Three months after operation explorations were made with a large 3-inch needle in four different situations where the tumor seemed softest. The needle was inserted to its hilt and in but one place was blood reached. An attempt to insert wire here was baffled by the clot beyond, as but 2 or 3 inches could be passed.

The patient died suddenly eight and one-half months after operation. No autopsy.

"The aneurism in this case was much too large and the cardiac condition much too unfavorable" for one to expect a cure to result. "That the patient's life was undoubtedly prolonged and his condition made much more comfortable was unquestionable." Dr. Stewart regrets not having used 20 instead of 14 feet at the first operation.

Case XIII.—Noble: 1898. The Philadelphia Medical Journal, Vol. I, p. 1203.

An Englishman; aged 37 years; alcoholic; history of syphilis.

Examination.—A pulsating tumor, the size of a large fetal head, midway between the ensiform cartilage and the umbilicus. Great pain, requiring much morphia.

Rest in bed, as nourishing diet as could be taken with his difficulty in retaining food, potassium iodid, opium. Condition grew rapidly worse and at the end of two weeks operation was decided upon.

Operation (July 14, 1897).—Laparotomy; 8½ feet of hard-drawn, No. 30 gold wire passed through a needle insulated with celluloid, and tipped with gold.

Current slowly increased until 70 milliamperes was reached, and here maintained for 6 minutes. In all, about 35 minutes of electrolysis. Patient showed marked signs of failure and had to be hastened off the table. No pain after the second day and improvement was rapid. Pulsation about stomach disappeared and patient was able to retain nourishment. Discharged in 6 weeks, with the mass lessened to the size of an orange. Transmitted pulsation and a slight thrill could be felt. Patient died 8 months later with acute dysentery, intercurrent with great debility, due to a tumor of lower jaw. He had had no further symptoms of aneurism. No autopsy.

Case XIV.—Halsted's case. See report below (Case I).

Case XV.—H. A. Hare: Therapeutic Gazette, May, 1898.

Man; aged 46 years; history of syphilis; on admission, suffering from pain, dyspnœa and cardiac disturbances; later he developed brassy cough, and sputum became tinged with bright-red blood.

From the signs and symptoms a diagnosis was made of aneurism of the terminal portion of the transverse and the beginning of the descending aorta.

Patient did not improve under treatment by rest, potassium iodid and aconite.

Operation (March 3, 1898).—Nine feet spirally wound fine gold wire introduced through an insulated needle, and a positive current passed for 1 hour, increasing rapidly from a few to 70 ma.

The operation well borne. Signs of consolidation somewhat apparent towards the end of the electrical session, in that there was less excursion of the mass and of the needle; and the needle

acquired the sensation of engaging a more solid mass. The aneurismal bruit, very marked in the second left intercostal space before operation, had much diminished the day following the operation, and in 48 hours had entirely disappeared. The expansile pulsation and the thrill had greatly lessened.

Five weeks later: "The expansile pulsation and the thrill have entirely disappeared and the impulse in the second left intercostal space feels as the apex beat would feel if displaced. The bruit has entirely disappeared and only a double aortic murmur is to be heard. Blood-spitting has not occurred. Cough has ceased."

The patient was in comparatively good health for 6 months after the operation, when symptoms began indicating the extension of the aneurism posteriorly and to the left. He died in October, 7 months after operation, from symptoms of pressure on the trachea. No autopsy.

CASE XVI.—Finney's first case. See report below (Case II).

CASE XVII.—Reeve: 1899. Annals of Surgery, Phila., Vol. XXX, p. 704.

A negro, aged 49 years, who had been ill for 2 years, was admitted to the hospital complaining of abdominal pain and presenting a large dome-shaped swelling in the upper umbilical region. This tumor had been discovered 9 months previously, and two months before admission it was diagnosed as an aortic aneurism. Pain was intense, the patient being kept continuously under the influence of morphine.

Under Schleich's anæsthesia, celiotomy was performed and 7 feet of silver plated, soft, copper wire, .016 inch in diameter, were introduced before a hindrance occurred. The wire had no previous preparation to insure its coiling in the sac. The positive galvanic pole was attached and the current gradually increased to 80 ma., where it was kept for 50 minutes. Not much suffering caused by the current except at one time, when for a few moments it was increased to 110 ma. "After 50 minutes, syncope was threatened, and the séance was discontinued. Distinct firmness of the tumor had occurred, as well as a disappearance of the expansile pulsation."

The patient lived 24 hours.

An extract from the pathologist's report says: "An aneurism of the abdominal aorta, two inches above its bifurcation. A wire, irregularly twisted, occupied the center of the sac, surrounded by and mixed with old and recent clot; one end, together with a double loop of wire, passed up the aorta, the looped part reaching about ten inches, and the single strand quite up to the aortic valves of the heart, where it left a spot of ecchymosis. The aneurism was distinctly sacculated; the opening from the aorta into the sac being not over one inch in diameter."

CASE XVIII.—Corson: 1899. The Phila. Med. Jour., Vol. III, p. 511.

Man; aged 31 years; excessive user of alcoholics; no definite history of syphilis. The patient complained of a hoarse cough and a severe pain under the left shoulder blade. His pulse was 110, and he was nervous and excited. Examination revealed a large pulsating tumor on the left side above the clavicle.

The trocar and cannula were inserted through the sterno-cleidomastoid muscle, and a drawn silver wire, six feet in length, was introduced. Eight cells of a dry-cell battery were used for two hours, the strength of current being regulated according to the patient's comfort. After a half-hour the pulsation began to grow less, and at the end of two hours the hardness of the tumor had much increased. Patient did well until the morning of the second day, when the cough and dyspnœa grew worse and patient died.

Autopsy revealed, as near as one can judge from the description, an aneurismal dilatation of the arch just above the heart, and from this an immense saccular dilatation, probably in the course of one of the large vessels on the left. In this latter sac was "the wire coiled closely in contact with its walls." We infer that pure silver wire was used, and nothing is said of the thoroughness with which it was drawn. Pure silver, only slightly drawn, and with no precautions to insure its coiling, would be almost certain to take the faulty position described.

CASE XIX.—Stewart's fifth case—not yet reported.

A traveling salesman of Baltimore, with a large thoracic aneurism had refused operation for some weeks, until his condition became very desperate. His life being threatened from dyspnœa, he went to Dr. D. D. Stewart, of Philadelphia, who wired his aneurism on three different occasions with very good result each time. But, unfortunately, the relief was temporary and the aneurism continued to extend until the patient's death from rupture about nine months, I believe, after the first operation.

CASE XX. Hare: 1900. Therapeutic Gazette, Phila., Jan. 15, p. 9.

A merchant, aged 48 years, with no history of syphilis. A rapidly growing aneurism eroding the second, third and fourth ribs and the costal cartilages to the left of the sternum. First noticed one year previously. For 7 months the patient had been in bed and had lost 60 pounds in weight. The most prominent part of the growth was elevated about two and a half inches above the surface of the chest, but there were three spots in which the blood was evidently near the surface, and in which expansile pulsation was marked."

Operation (April 18, 1899).—The needle inserted into the apex of the growth and ten feet of gold wire introduced, and a current passed for one hour and thirty minutes, beginning at 10 ma. and gradually increased to 100 ma.

Marked improvement in the patient's condition, allowing him to sit up a portion of each day and to walk a little. The aneurism shrank and lost its expansile character except at one point. Because of this point of pulsation, Dr. Hare operated one month later in a similar manner, but this time he passed a second ten feet and kept the patient under the electrolysis for a second hour.

The aneurism persisted, and after two or three months gave evidence of extension to the left. Dr. Hare contemplated a third operation, when the patient died from rupture of the sac, on November 30. No autopsy. Dr. Hare says: "I have no doubt that his life was much prolonged in view of the thin sac wall at three points when he was first seen, all of which were threatening rupture at any moment."

CASE XXI.—Finney's second case. See report below (Case III).

CASE XXII.—Finney's third case. See report below (Case IV).

CASE XXIII.—Finney's fourth case. See report below (Case V).

Five cases have been operated upon at the Johns Hopkins Hospital, a report of which shows an interesting development of technique. The records of the first two cases, which were fatal, and upon which autopsy was held, and of the last case, are particularly valuable in showing the extreme difficulty in diagnosis of the actual condition, even with celiotomy. Appreciation of these difficulties will aid in making the prognosis sufficiently grave when laying the question of operation before the patient and his friends.

CASE I (Case XIV of entire series).—W. T. G., a printer, aged 27 years, was admitted, October 26, 1897, to the service of Dr. Osler. Dr. Norton, of Washington, sent the patient with the diagnosis of abdominal aneurism.

History.—Since a boy he has always been accustomed to holding type in his mouth. He has carried heavy "forms" of type resting against his abdomen, and has lifted heavy weights in the gymnasium. He has had several attacks of gonorrhœa, and about seven years ago an attack of acute arthritic rheumatism which he thinks was synchronous with urethritis. No definite history of syphilis. He has been a pretty heavy drinker of alcoholics since a boy.

His present trouble dates since May or June of this year, when he began having a "dull dragged-out feeling" and occasionally sharp pains across the abdomen, which caused him to lie doubled across his printer's stool for the pressure benefit. At this time he often vomited after eating, but has not vomited for the past two months.

The pain and weakness have increased since May and he has lost about forty pounds in weight. During the past month he has been obliged to sleep on the left side or in the erect posture, because of pain when in any other position. Pain is referred to the pelvic region, at times shooting into scrotum, at times extending even to the knees. In walking the street a sudden jar gives great pain. He walks slightly bent forward to avoid pain. He first noticed pulsation in the abdomen one month ago.

On physical examination he is found to have moderately sclerosed arteries; a markedly accentuated second aortic sound; no blue line on the gums or other evidence of plumbism.

On inspection of the abdomen a diffuse pulsation over the whole upper abdominal region, most marked in the left epigastrium, is seen. This region is prominent, and the left costal margin over the sixth and seventh cartilages is bulged slightly forwards. The pulsation is felt to be limited to the upper half of the abdominal aorta, over which a globular expansile mass the size of a very large orange can be outlined. A purring systolic and diastolic thrill is felt over the mass. Percussion gives dullness everywhere over the mass, but later, during observation, stomach tympany is found on percussion over its lower quadrant. On auscultation a loud double murmur—a systolic, loud, harsh, and short—a diastolic, fainter, prolonged, and almost musical in character—is heard. In the back a soft blowing systolic murmur is heard over an area to the right of the vertebræ extending from the eleventh dorsal to the first lumbar. The knee-kick is somewhat exaggerated.

The patient was irritable and incapable of restraint. He was kept on a moderately low diet and as quiet as possible on anodynes; but it was evident from the first that the aneurism was increasing in size and would, in all probability, soon prove fatal.

After having the possibilities of the operation presented, he begged that the attempt at cure might be made. He was transferred to the service of Dr. Halsted and, on November 24, operated upon.

A median incision was made from ensiform to umbilicus, exposing a pulsating mass in the epigastrium, seemingly about fist-size, lying behind the lesser peritoneal cavity. This could be reached only through the lesser omentum by pulling down the stomach and approaching the sac above the lesser curvature. An area 1 x 2 cm. was laid bare over the sac wall by blunt dissection through the posterior layer of the lesser peritoneal cavity and its underlying subserous fatty layer. The wall of the sac seemed very thin at this point. A distinct expansile pulsation and a thrill were perceptible to the fingers. A hypodermic needle was inserted to test the thickness of wall. A long aspirator needle of small caliber was inserted and an attempt made to pass a No. 27 wire (No. 5 piano-gage). This was of pure silver and undrawn, and had been rolled on a wood reel and boiled. After passing a few inches the wire kinked and both needle and wire were withdrawn. Bleeding followed but was easily controlled by pressure of a finger.

The needle was oiled and again inserted, and about 17 inches of No. 27 wire introduced, when it again kinked. The current was passed through this for 12 minutes. The needle was withdrawn and the wire, being cut off near the sac, was pushed under the surface by catching it in the point of an aspirator needle.

A third and larger aspirator needle was now inserted and 38 inches of No. 25 wire (No. 4 piano) were passed through it with ease. Considerable bleeding took place from the lumen of the large needle, so it was withdrawn and the wire cut about a foot from the sac. Hæmorrhage was controlled by slight pressure of a finger beside the wire at its site of entry.

The galvanic current was then passed, the anode being connected with the end of the wire, and the kathode with a large metal plate, wrapped with a towel and placed under the back. The electrolytic action was continued for 1 hour and 25 minutes, varying in strength from 30 to 100 milliamperes. At its height, the current caused contracture of the muscles of the trunk when there was any change made in its strength by the rheostat. No appreciable change took place in the pulsation of the aneurism during the process. The wire was cut off close to the sac and the posterior peritoneum closed over the site of puncture with fine silk sutures.

There seemed to be no other abnormality of the patient's abdominal viscera. His pulse varied between 90 and 120 during the operation.

He lived about 40 hours after operation and died with symptoms of sudden internal hæmorrhage.

Autopsy Notes.—Abdominal wound, 16 cm. long, firmly glued together. A few delicate adhesions of omentum to abdominal wall beneath the incision. The aneurismal sac is collapsed; it lies behind the lesser peritoneal cavity to the left of the vertebral column, extending slightly beyond the right margin of same. It extends from the diaphragm to which it is firmly adherent to the renal vein, which runs transversely over its lower anterior edge.

It pushes the spleen to the left and touches the upper anterior surface of the left kidney. The pancreas lies over its lower third.

The left pleural cavity is found to contain an immense blood-clot, forming a complete mould of the cavity and weighing 1170 grams. In addition, 960 cc. of fluid blood are removed. The diaphragm is seen to bulge considerably into the pleural cavity, and at the summit of the dome is a ragged hæmorrhagic area, the site of rupture. A little to one side of the perforation, which scarcely admits the tip of the little finger, lies a loop of the wire.

On opening the aneurism and the aorta the aneurismal opening is found to have a vertical diameter of 8.5 cm., while that of the sac is but 10 cm.

The aorta in this region presents a fusiform dilatation, its right border projecting slightly beyond the right margin of vertebral column. The anterior wall of this dilated portion of aorta is very rough and atheromatous, and peculiarly elastic. The posterior wall is thinned and so adherent to the vertebræ that these have to be chiseled away in order to remove the aorta and sac.

The aorta is considerably narrowed below the sac, its circumference above and below the aneurism being respectively 4.8 cm. and 3.4 cm. The chief abdominal vessels arise from the lower left portion of the sac; the celiac axis and superior mesenteric coming off within the sac, while the renals spring from the dilated aorta just at the mouth of the sac.

The wall of the aneurismal sac is everywhere thin; being thickest anteriorly and to the left, where the retroperitoneal tissues have assisted in strengthening it, and thinnest superiorly where it bulged toward the pleural cavity. Its inner surface is rough and covered with loose coagulum, there being no evidence of uniform lamellated deposit of fibrin.

The walls are held apart by 4 or 5 coils of silver wire, which

lie peripherally and near together, forming an ellipse whose plane is anterior-posterior with reference to the body. These coils are covered by loose coagulum, which readily becomes detached on manipulation.

Death, from rupture of the very large, tense and thin-walled sac, with enormous mouth, could not have been long delayed; but it is probable that it was hastened by the wire working against the sac wall.

Considering the position of origin of the celiac and superior mesenteric vessels from the wall of the sac, there can be no doubt that the patient's death would have been even more precipitous had there been a formation of an obliterating clot during the operation.

CASE II (Case XVI).—R. E., book-keeper, aged 25 years, admitted to the service of Dr. Osler, July 29, 1898, complaining of an abdominal tumor with pain.

Family history good.

Personal history.—Childhood's diseases, no scarlet or typhoid fever, no diphtheria or lung trouble. Malaria for several summers as a boy. No rheumatism. Urethritis at 19 for 2 or 3 months; no sequelæ. Bubo at 21, on both sides; knows of no cause, but at the same time had an herpetic eruption on penis. Had not been exposed in venery for 2 or 3 months before this. Alcoholics very moderately. No tobacco. No heavy work. No traumatism.

Present illness.—In October, 1897, the patient had a severe pain of a sharp, steady character just below the umbilicus. This lasted one week, keeping him awake at night. He had no more trouble until March, four months ago, when he noticed tenderness on the right side just below the costal margin and in the flank. In a few days such severe pain set in that opiates were resorted to. Gradually his skin became yellow and his urine very dark. The stools were never noticed to be clay-colored. The jaundice was of five weeks' duration. The pain has gradually increased since March, never being of a throbbing character.

Physician's examination in April was negative. On July 20, he was examined under anæsthesia and a diagnosis made of abdominal aneurism.

On admission, careful physical examination was negative, except for sclerosed arteries and the abdominal tumor.

In the epigastrium was seen a marked pulsation. On palpation a marked shock and distinct purring thrill were felt with each systole. One could outline a globular mass about as large as a medium-sized orange, and from this get expansile pulsation. On auscultation, a loud, amphoric, systolic murmur was heard, limited to the tumor area. No diastolic murmur. Second sound very faint. No murmur heard at the back.

Operation.—During one month of treatment on absolute rest, restricted diet, and iodid of potassium, the aneurism continued to enlarge and the pain to increase.

On August 27, Dr. Finney performed the Moore-Corradi operation. Under ether a median incision was made from ensiform to umbilicus, exposing the lower border of liver and upper border of stomach. Between these lay the sac almost completely hidden by a flattened-out pancreas.

The sac seemed globular, about 7 cm. in diameter, and apparently extended around the aorta, resting on the transverse processes of the vertebræ. The pancreas was separated with difficulty and finally had to be divided in order to expose the sac. Beneath its upper border and flattened out across the sac was the splenic vein, about 1 cm. in breadth. Puncture was made in the upper edge of the sac just above this vein, the needle pointing downward and as nearly parallel with the aorta as convenient. Five feet of silver wire were passed through this fine insulated aspirator needle. The wire was alloyed with 75/1000 of copper and drawn from No. 8 to No. 27. After being smoothly wound on an ordinary spool, it was boiled for 15 minutes for sterilization and to give it a good spring following the swelling of the wooden spool. The wire was passed without particular difficulty by grasping it between the thumb and first finger and passing very short portions at a time. Slight oozing through the needle made the fingers very slippery, and they had to be repeatedly rubbed over an alcohol sponge.

The galvanic current was begun at 30 ma. and increased 10 ma. each 5 minutes until 70 ma. was reached, where the current was kept one hour.

After a half-hour the thrill, very marked at the beginning, had disappeared. The expansile pulsation had decreased but seemed to increase with each addition of fresh ether and resultant stimulation of the heart. At the end of this electrical session there was no thrill; no expansile pulsation could be determined; the sac was firm and decidedly smaller, as could be seen by the manner in which the splenic vein, before flattened, now stood out on the sac as a rounded vessel. After closing the abdomen nothing but a communicated pulsation, as of a solid tumor lying over the aorta, could be made out.

The success of the operation seemed assured; but, from his recovery from ether, the patient complained of excruciating pain, which increased until, within a few days, morphia was being given in ¼-gr. doses every 2 to 4 hours.

His temperature on the day following operation reached 102.5°, and on the third day 103.7°. Careful examination of the wound revealed nothing, although we had feared infection of the tissues made necrotic about the needle from the electrical current, and over this area in the mutilated and much ligated pancreas.

We decided that this temperature must be due to the sloughing tissues over the back; for the metal plate, which had been wrapped with a towel repeatedly moistened, had caused an unlooked-for necrosis of the skin. But on the 7th day pus was found in the upper half of the wound, apparently involving only the subcutaneous and muscular layers of the abdominal wall. The temperature lowered somewhat but remained about 100° F. until the 14th day, when it again went up, reaching 102.8° F. on the 17th day.

For the first four days no expansile pulsation could be made out, but on the fifth day it was distinct, and the sac from this time seemed to increase in size. On the 16th day nausea began, and from this time the patient was in extreme discomfort. On the 19th day there was bleeding of about 300 cc. of bright-red blood from the upper end of the granulating wound. The patient became very weak and pale, and it was evident that he was having internal hæmorrhage. He died on the 20th day, 7 hours after the hæmorrhage through the external wound.

Autopsy (No. 1144).—The lower end of the abdominal wound healed per primam; the upper end separated and granulating. On opening the abdomen there was found a sinus, filled with blood-clot, leading from this granulating wound down to the sac at the site of puncture. Local peritonitis existed about the wound. The lungs were normal. The heart presented slight thickening along the free margins of the tricuspid and mitral valves. The aorta beyond the valves showed well-marked nodular, and in places diffuse arterio-sclerosis. The patches were a trifle raised and of yellowish-white color. This condition extended into the abdominal aorta.

In the upper portion of the abdomen, partially covered by the pyloric end of a distended stomach, the beginning of the duodenum, and the right lobe of the liver, was a firm globular tumor mass. Flattened out over this and almost completely covering its anterior aspect, was the pancreas. The splenic vein ran across the tumor near its upper border and was covered by the pancreas. Just above the vein was the sinus of blood-clot before mentioned.

At the upper border of the tumor the celiac axis could be dissected free with its three branches.

On opening the aorta by cutting along its posterior wall, an opening 1½ x 1¾ cm. in diameter could be seen on the anterior wall leading into the aneurism. This was evidently the greatly dilated orifice of the superior mesenteric artery, of which artery the aneurism was a dilatation. One centimeter above this opening was the orifice of the celiac axis. The inferior mesenteric arose 3¾ cm. below.

The renal arteries, one on either side, took origin on the lower margin of the opening.

Near each renal orifice, immediately on the margin of the aneurismal orifice, was a blackened slit-like sulcus in the arterial coatings. Although there was no wire in the mouth of the aneurism at time of autopsy, it appeared as though one loop had swung across the mouth with its convex side in the aorta, thus burning the margin as described. (From this, as well as from experiments upon free blood and upon dogs, we conclude that a current of 70 ma. is dangerous.)

Looking into the aneurism through its comparatively small orifice, one could see numerous segments of coiled wire immediately about the mouth of the sac, the greater portion of each coil being embedded in a solid ante-mortem clot, which apparently almost filled the sac. Further examination was postponed until the specimen could be hardened.

The marked dilatation of the stomach was apparently due to pressure on its pyloric end as it crossed the sac. The bile-ducts were incorporated in the misplaced tissues to the right of the sac, and this suggests pressure as the cause of jaundice in the early history of the patient's suffering. The duodenum was adherent to the sac throughout its whole length. The duodenum, the jejunum, and the upper portion of the ileum were of a dark chocolate color, and on being opened were found to contain considerable bloody fluid. Their mucosa was of the same chocolate color, but seemed otherwise normal, except at one portion of the adherent duodenum.

At about the transverse portion of the duodenum there was an irregular area measuring about 4½ x 6½ cm., over which the mucosa was exceedingly hæmorrhagic and partially necrotic. Just in this locality were found, in addition to the bloody fluid, several large fresh clots. No definite opening into the aneurism could be found, and our conclusion was that very rapid oozing had taken place through the greatly thinned walls of the adherent sac and bowel.

The large intestine was normal in appearance.

The pancreas over the tumor showed no trace of having been cut in two. There were a few small white areas of necrosis over its surface.

The spleen was considerably enlarged but otherwise normal in appearance. The liver was rather pale, and on section has a fatty appearance. The kidneys showed macroscopical evidences of parenchymatous degeneration.

The Aneurism.—On cutting through the aneurism dorsoventrally (see photograph) one gets the impression that we are dealing with a *false* aneurism. Immediately about the aortic opening is the remainder of the dilated lumen, which, in the contracted condition of the sac, is a cavity about 4 cm. in diameter.

The wall of the aneurism may, for convenience of description, be divided into two portions—the ante-operative and the post-operative. Each of these averages about 2 cm. in thickness.

The ante-operative portion consists macroscopically of two layers: an outer, light-colored, fibrinous-looking layer (see cut) (*a*), averaging ½ cm. in thickness, which merges into the inner layer (*b*), 1½ cm. thick, and dark-red, appearing like an old firm clot.

Near the aorta the greatly hypertrophic superior mesenteric wall can be traced for a short distance until it is lost in the looser and thicker portion described above. The wall is reinforced near the aorta by the mesenteric lymph glands; on the inferior border, by the adherent duodenum; and over the anterior and superior border by the flattened pancreas.

Microscopically, as macroscopically, the hypertrophied wall of the superior mesenteric can be followed but a short distance from the aorta. Microscopically the muscular wall terminates rather abruptly and its elements cannot again be identified to a certainty, although there are sweeps of fibers with long, delicate nuclei scattered throughout the wall, which cannot always be identified as sympathetic nerve elements.

The peripheral light-colored portion of the wall shows fibrous tissue interspersed with such elements as one would expect to find in the wall of an expanding sac in this region. Areas of fat usually arranged in layers; and in portions of the wall the ganglia and nerve bundles of the sympathetic system are conspicuous. Lymphatic glands and vessels are seen; and, in the localities mentioned above, tissues of the duodenum and pancreas.

The inner red layer of the ante-operative portion consists of the same variety of tissues as the outer, together with a great admixture of blood elements. The picture is one of dissection of the wall by the force of the blood stream. The strands of fibrous tissue are often in a state of hyaline degeneration, probably due to their separation from a good blood supply. The capillaries of this region, although not numerous, possess cells with swollen nuclei and are rather conspicuous; but Professor Welch, who kindly examined some of the sections, classes them with the displaced tissues rather than products of an attempt at organization, it being a characteristic of aneurism clots not to organize.

The post-operative portion of the aneurismal wall (*c*) consists of an ante-mortem blood-clot, in the center of which can be seen the ends of the wire cut across on sectioning the aneurism. The position of the wire in the former lumen of the sac and its relation to this solid blood-clot shows the efficacy of the method, had the case been one anatomically favorable.

On making a lateral section from the first median incision and extending towards the duodenum, we find that the outer fibrous-like wall is entirely wanting at the point where the oozing took place into the duodenum, and the blood-clot within the aneurism lies in immediate contact with the blackened necrotic duodenal wall. The lumen makes in towards the duodenum at this point, but there is 2 cm. of ante-mortem clot separating the lumen of the sac from that of the duodenum. The process of fatal bleeding must have been an ooze, but the giving way of the necrotic duodenal wall was imminent.

Case III (Case XXI).—J. T., a sea captain, aged 51 years, was admitted to the service of Dr. Osler on April 24, 1899, complaining of pain in the right chest.

His family history was good. His personal history was negative, except for very hard work at sea until within a few years.

His pain began 7 months before admission and had gradually increased. Dyspnœa began in February, 1899.

On physical examination dilated veins were seen over the whole chest and abdomen, being most prominent on the right. The whole sternum was lifted with each systole, while to the right, between the second and third ribs, could be localized an area of maximum impulse. Here a systolic murmur could be heard and a diastolic shock felt. Expansile pulsation was pronounced. The heart was negative. The right lung on percussion gave a dull note throughout the right front and in the axilla, and distinct impairment of resonance existed in the right interscapular region.

The patient suffered great pain over the entire right chest and toward the right shoulder.

His condition grew worse and, on April 25, gelatin injections were begun, the patient receiving 250 cc. of a 1 per cent solution

subcutaneously. After 9 injections of a 1 per cent solution, the strength was doubled. Between April 25 and July 27, 17 injections were given, with the result of lessening his pain and reducing the force of his pulsation.

On August 11, Dr. Finney operated, passing into the sac 10 feet of the silver wire alloyed with copper, drawn, and prepared as described in the above report on Dr. Finney's first case. The galvanic current was applied for 1 hour at 10 ma., and for 15 minutes at 20 ma.

Cocaine was injected over the point to be punctured. After loading the needle with wire, the skin was drawn to one side and the needle inserted pointed toward the right portion of the sac. After passing through the skin and about 2 cm. of subcutaneous tissue and muscle, a few drops of sanguinous serum came through the needle. After this the needle was felt engaged in a solid substance for about 2 cm., when it suddenly broke through and a stream of arterial blood spurted with each heart-beat. The wire was easily passed within 5 minutes and the end attached to the positive pole of the battery. Throughout the session the patient felt a slight sticking and burning within the chest, and for the first 20 minutes a sensation as of something moving from side to side. After 40 minutes a current of 20 ma. was tried, when the burning sensation increased. The current was immediately reduced to 10 ma. After an hour the burning sensation ceased and the current was increased to 20 ma. for 15 minutes, causing no sensation to the patient. On withdrawal of the needle a slight flow of blood through the puncture wound was readily controlled by a few moments' pressure with a gauze sponge. Wound dressed with silver foil and adhesive strapping. The pulse, usually about 100 to the minute, beat at 110 to 112 during the operation.

The patient's condition, which was not bad for a week before the operation, seemed to change very little after the operation. On the third day he stated that he could no longer feel a pulsation while lying on his right side, and during the previous night he noticed for the first time that the pulsation was not so strong when lying on his back.

After a week the pulsation was as marked as before the operation, and seemed shifted somewhat to the left of the original site. His pain began again, and on the twelfth day the gelatin injections were again begun.

The patient was dismissed September 22, having had 16 gelatin injections after his operation. His condition was much improved, the pain having ceased and the wall of the sac manifestly thicker. The effect of the wire in this case seemed to be a partial filling of the large sac, causing extension toward the left. There can be no doubt that the gelatin injections were very beneficial in this case.

Patient returned September 30 because of shortness of breath on the slightest exertion, he having had no pain during the week at home.

On October 16 the patient went home, after several gelatin injections, his condition being about the same. He recovered sufficiently to again take up active work in the refitting of a dismasted ship, and whenever seen he always claimed to be perfectly well. He sailed as captain, and on the arrival of his ship at Bahia, Brazil, a cablegram was received at Baltimore, announcing his death and burial at sea on February 14, 1900. It is highly probable that death was due either directly or indirectly to his aneurism.

CASE IV (Case XXII).—J. F. G., a steam-shovel tender, aged 39 years, was admitted, October 9, 1899, to the service of Dr. Osler, complaining of pain in the chest, a dry hacking cough, and shortness of breath. His family history was negative. His personal history included gonorrhœa and possibly syphilis. He had been a heavy eater and moderate user of alcohol and tobacco. Until within a few years he had been subject to heavy work and much exposure.

His present illness began about 18 months ago with sharp spasmodic pains in the chest, lasting 15 to 20 minutes. These attacks were almost daily and often recurred several times during a day. At times, during the early history of his trouble, he had attacks of suffocation and feeling as though about to die. The attacks of pain increased in frequency, and for the past 5 months the pain has been continuous.

About 5 months ago bulging was noticed over the painful area on the right side of the chest; and, a skiograph being taken, his trouble was pronounced aneurism.

On admission, the patient was obliged to keep a half-sitting, half-reclining posture, and suffered a varying degree of cyanosis and dyspnœa. His pupils were equal and reacted to light and accommodation. The voice was husky and he was subject to a dry hacking cough. The pulse was slightly irregular and distinctly collapsing, there being no appreciable difference in time of the radials. No tracheal tugging.

The thorax was less expansile on the right side. On the right side, extending from the right mammary line to the median line and from the second rib to the costal margin, there was an area of bulging and pulsation. At the right sternal border in the fifth interspace there was a small area of unusual prominence, excessively tender to the touch and presenting a pulsation of maximum intensity. Here the pulsation was vigorous, expansile and close to the fingers. A diastolic shock could be felt and a diastolic murmur heard over this area.

The heart was somewhat displaced downward and to the left. A soft diastolic murmur was audible at the apex and over the aortic area. The other sounds were clear. The second pulmonic was accentuated.

The liver extended 7 cm. below the costal margin in the mammary line. There was well-marked movable dullness on the right side and a friction rub in the interscapular region.

From the time of admission the pulsation and prominence of the area in the fifth interspace continued to increase. The patient suffered frequent attacks of shortness of breath and cyanosis. During the first three weeks the right pleural cavity was aspirated three times, a half-liter or more of a clear, serous fluid, slightly blood-tinged, being withdrawn each time. A diagnosis was made of aortic aneurism, probably springing from the ascending arch near the heart, possibly coming from the descending thoracic portion.

On October 27, Dr. Finney operated, passing 10 feet of silver wire (alloyed with copper, drawn, and prepared as described in Dr. Finney's first case), and galvanizing this with 10 ma. for 1 hour. The excitement incident to the preparation for operation resulted in a marked attack of dyspnœa, and amyl-nitrite was used for inhalation. The patient was allowed to keep the upright position in his wheel-chair. A fine aspirator needle loaded with wire was introduced in a direction downward and to the right.

It was our intention to introduce a second needle and play in a second 10 feet of wire, but just as the first spool was exhausted the wire offered decided resistance and the patient said he could feel a grating sensation within. We took these two circumstances as evidence that enough wire was passed.

The patient volunteered the information that he could feel a 5-ma. current, and after five minutes that he felt the change from 5 to 7 ma., and again the change from 7 to 10 ma. During the hour at 10 ma. the patient had occasional slight burning or prickling sensations within his thorax; and the metal plate wrapped with a wet towel had to be changed once because of the burning sensation at the back.

At the close of the operation the expansile character of the pulsation had disappeared, while the heaving was still present.

The patient slept during most of the afternoon following

operation, and for 15 days the condition of his aneurism improved markedly. His general condition was kept at a low ebb because of the repeated filling of his right pleural cavity, which was aspirated every few days up to the time of death.

On November 15, Dr. Osler noted that the tumor was increasing in size, and on November 20 rupture seemed so imminent that Dr. Finney again wired the sac, this time passing 11 feet of wire and galvanizing as before. Again the improvement was decided but only temporary.

The patient was wired the third time on December 8 (11 feet being passed), and on the 29th an incision was made through the thinned and necrosed skin for the drainage of a large collection of sanguino-purulent material which had appeared in the extra thoracic tissues over the site of the aneurism.

The aneurism was now deep-seated and the symptoms of increasing shortness of breath, hæmoptysis, and venous engorgement of the head region indicated an extension backward. The patient had very little pain from the time of admission and anodynes were given, more for sleeplessness.

On January 14, 1900, about 11 weeks after the first wiring, the patient died, with symptoms of pressure upon the trachea. Autopsy was refused.

Case V (Case XXIII).—M. P., a sewing-machine agent, aged 30 years, was first admitted to Dr. Osler's service on October 31, 1899, complaining with what his physician had called "kidney and stomach trouble."

His family history and personal history were excellent, containing nothing to arouse a suspicion of arterial disease. His present illness began in March, 1899, with the gradual onset of intermittent pains of a burning and gnawing character located in the stomach region. These pains seemed to have no association with the taking of food. Within a month his suffering became so intense that he was forced to bed, where he remained for 3 months, requiring the continued use of morphia injections.

The pain was of a boring character, seemed central in the epigastric region, and radiated in every direction, being especially severe in the back and often shooting into the scrotum. During this 3 months he had some nausea and suffered 6 attacks of vomiting, during one of which he thought he would die. His appetite and general condition were good. He lost some weight. His bowels required the constant use of laxatives.

In July he became enough improved to leave his bed for a portion of each day, but the slightest exertion increased his pain.

In this condition he entered The Johns Hopkins Hospital and remained for 3 weeks in November.

Physical examination revealed nothing of moment except the condition of the abdomen. This was fairly normal in appearance; the costal grooves, however, being slightly less marked than usual. The iliac grooves and lumbar lines were equal and symmetrical on the two sides. Both hypochondriac regions were pigmented as a result of blisters. The epigastric region was slightly full and showed marked visible pulsation. Here there was extreme sensitiveness to pressure, with distinct resistance on deep palpation. No definite expansile pulsation could be made out at the first examination. On percussion there was dull tympany over the pulsating area. No thrill could be felt. There was a very faint systolic bruit. With the patient in the knee-elbow position, no pulsation could be felt except on deep palpation. Pulsation seemed equal in the femorals. In the back there was no bulging on either side of the spinal column, no pulsation, no bruit. Six days after admission, Dr. Osler noted that with deep palpation a definite expansile pulsation could be determined, and with deep pressure on the left side the sac could be felt.

During his 3 weeks in the hospital, the patient suffered severe pains across the upper abdomen, extending especially along the right costal margin. This pain was often relieved by pressure from without, or by the patient lying on his left side with his head lowered.

After 2 months at home, the patient re-entered the hospital, January 14, 1900, having decided to undergo the operation advised. He had lost 6 pounds in weight since leaving the hospital. The pains had increased in his lumbar region, and for 3 weeks past he had experienced a burning sensation in his knees and ankles.

Operation (January 26, 1900; Dr. Finney).—Celiotomy; passage of 8 or 9 feet of highly drawn sterling silver wire; galvanism for one hour at 10 ma.

The conditions found in Case II were almost exactly duplicated in this case. The pulsating mass was covered over its lower portion by the stomach, over its upper portion by the pancreas, and the large splenic vein traversed its convex surface. The procedure was the same as in Case II, except that section of the very hæmorrhagic pancreas was avoided by drawing the liver to the right and making the puncture in the upper right quadrant of the sac. The patient bore the operation well, his pulse ranging about 110 beats to the minute. At the close of the electrical séance there was no appreciable difference in the pulsation of the sac. This fact, together with the anatomical relations of the mass, made it seem very probable that the aneurism was one of the superior mesenteric artery, as in Case II. Except for middle-ear trouble, the patient's convalescence was uneventful. He was very happy over the marked improvement in his symptoms, insisting that he must be getting well because of the slight amount of pain compared with his former condition. But there was no appreciable improvement in the physical signs. On the day of his discharge, March 8, Dr. Osler made the following note: "Patient says he suffers less pain. He looks well. Pulsation chiefly seen in the epigastric region and appears a little more diffuse than formerly. On palpation the pulsation is most intense just below the ensiform. The tumor is still well felt on deep lateral pressure. No thrill felt. A soft systolic bruit is heard. No pulsation or murmur behind."

It might be argued that the current of 10 ma. was not sufficient in this case. But I am satisfied from the history at and since the operation that this was a case of fusiform aneurism, probably of the superior mesenteric artery, and its outcome is another argument in favor of the weaker current when we compare the results with Case II, which barely escaped an infarct of the whole small intestine from the sudden closure of the superior mesenteric artery.

Dangers.—Needless to say that sepsis is an omnipresent danger, especially in these cases characterized by large non-vascularized accumulations of blood and fibrin, and all details of surgical cleanliness should be strictly carried out.

One of the greatest dangers in this procedure, particularly in the large multilocular aneurisms, is the development and rupture of a secondary sac due to the rapid filling of the main sac by coagulum and the shunting of the blood stream against a portion not receiving a special strain before. Apparently this occurred in the cases of Domville, Cayley, Ransohoff, Hulke, Barwell, and in Stewart's first case. Loreta's unique case of rupture of the aorta at its juncture with the base of the former aneurism was probably caused, as he suggests, by lack of nutrition to the wall due to changes in the circulation brought about by contraction of the organizing sac. General arteriosclerosis would weigh against operation.

The chances of a loop of wire entering the aorta seem less than one would a priori suppose. Moore expresses surprise

that in his case, with large openings in the second and third interspaces connecting the extra- and intra-thoracic sacs, no wire entered the inner sac. The accident has occurred in three cases upon which autopsy has been held. In Ransohoff's case the aneurism of the ascending arch was very large, 4 x 7 inches, and its opening into the aorta was comparatively small, 1 inch in diameter; yet a loop of wire left the sac and descended low enough to interfere with one of the valves, causing syncope that for a few moments threatened death. In White and Gould's case the opening from the sacular aneurism into the large fusiform aneurism of the aorta easily admitted four fingers. A loop of wire entered the fusiform dilatation causing no symptoms. Reeves's case, which, from the report, seems to have been an ideal one for this method, possessed only a small opening from the perfect sac low down on the abdominal aorta. Through this opening the first end of the wire passed into the aorta and up to the aortic valves probably causing the syncope as in Ransohoff's case, and later a loop entered and passed up the aorta a distance of 10 inches. In none of these three cases was the character of the wire or its previous treatment such as to make probable its coiling after entering the sac.

One would suppose that a loop of wire in the aorta would whip out fibrin and present a menace in the form of emboli, but nothing is said of fibrin in any of these cases, while in the large fusiform aneurism of Kerr (his first case), where electricity was used, there was found a firm clot around the wire and on the walls. The wire had taken a position in the anterior portion of the sac and may have been out of the direct aortic current. In Stewart's third case there was no clot about the wire which had been in the fusiform aortic dilatation five days. While clinical experience shows that wire without galvanism will collect fibrin in the lessened current of a sac, it is probable that it will not do so in the active aortic current (see our last dog experiment). But our dog experiments demonstrate that wire with galvanism separates the fibrin even in an aortic current which is but little reduced, and in these cases in which the wire has entered the aorta and is found fibrin-free at autopsy we must believe that fibrin was formed during the electrical séance to be brushed off later and become a menace to life.

The size of the sac opening cannot be diagnosed from the character of the bruit although it is generally held that a double systolic and diastolic bruit is indicative of a small opening. Against this theory see Halsted's case.

Another danger is that of emboli breaking from the sac wall during or after the insertion of the wire. This may have been the cause of death in Roosevelt's case. No autopsy was held.

Halsted's case and Finney's first case bring up the danger of closing important vessels by the sudden filling with clot of an abdominal aneurism. Litten[15] by his clinical and experimental research demonstrates that sudden closure of the superior mesenteric artery can have but one result; namely, haemorrhagic infarct from the lower end of the duodenum to the middle of the transverse colon.

We have mentioned the possibility of puncture of the sac wall especially on passing steel wire. But this danger is more theoretical than real, for the wire begins to coil soon after leaving the needle and is almost sure to impinge on the sac wall with a segment of a coil rather than with its sharp end.

Loreta suggests the danger, in abdominal aneurism, of the sac giving way when the abdomen is opened, and the support of the abdominal walls thus removed.

Failure might result, particularly in aneurism of the thorax, because of the presence of a double sac, both intra-thoracic, as in the cases of Domville and of Corson, or one intra-thoracic and one outside the ribs as in the cases of Moore, and White and Gould; or one might successfully treat a saccular dilatation of the aorta, and still be confronted by a failure because of the presence of a fusiform aneurism. Such anatomical conditions were found in the cases of Domville, Cayley, and White and Gould. Failure in Hare's first case (Case XV), the fifth case of Stewart (Case XIX) and in Finney's second and third cases (Cases XXI and XXII) was possibly due to the insufficient filling of a large single sac; but it is more probable that each of these cases possessed a multilocular sac and the gradual extension was due to bulging of unfilled loculi.

Failure must be expected if an error in diagnosis be made and a fusiform sac be treated—as in Stevenson's case, Kerr's first case, Stewart's third case, Finney's first case, and Corson's case.

Results.—Do the results so far obtained justify a continuance of this method? With Moore's method of wire alone we see that 14 cases have been treated, 8 thoracic and 6 abdominal. Two of these, Morse's and Langton's cases of abdominal aneurism, resulted in cure. Loreta's case of abdominal aneurism resulted in cure of the aneurism but unfortunately the patient died three months later from rupture of the aorta. In all but four of these cases, those of Murray, Loreta, and Morse and Langton, it is definitely stated that the patient was in a desperate condition and it is a matter of speculation how much death, occurring in from one day to one month after operation, was hastened. Rubio's case was lost sight of after four days. Lange's case had already ruptured before treatment. Of the remaining nine, not counting Loreta's, Morse's and Langton's, we get the impression that death was hastened in four, those of Moore, Hulke, White and Gould, and Stevenson. Autopsy was held in nine cases and in all the effect of the wire in whipping out fibrin was marked.

With the combined method (Moore-Corradi) there have been 23 cases, 17 thoracic and 6 abdominal. Four of these, or 17 per cent, 3 thoracic and 1 abdominal, were cured. Here we must speak with reserve, for knowledge of the living patient or proof gained by autopsy are at our command for but two of these cases. Rosenstirn's patient after 11 years is alive and well. Stewart's second case was one of definite cure as shown by autopsy more than 3 years after operation. It seems fair to consider Kerr's second case cured. He left the hospital two months after operation, with every indication of

having been cured, was watched at work as street paver for 10 months and then lost sight of, although he promised to return should he ever have more trouble. Noble's patient lived 8 months with no signs or symptoms of his abdominal aneurism and died from an entirely different cause.

Nine cases, or 39 per cent, attest the value of the operation by amelioration of symptoms and prolongation of life. Here again we must not be too sanguine, for in any given case we cannot prophesy as to his length of days or degree of suffering if there be no operative interference. Buresi's case was greatly relieved but soon died, 3¼ months. Hershey's case, apparently cured, returned to his very active work as mining prospector, and had no trouble until 12 months after operation, when the symptoms of aneurism again developed and he died from rupture two months later. Stewart's fourth and fifth cases were decidedly improved, one living 8½ months and the other 9 months after the first operation. Hare's first patient enjoyed comparative comfort for 6 months after operation but died at the end of 7 months. His second case lived 7 months after the first operation and Dr. Hare says there can be no doubt that his life was prolonged. Finney's second case improved so far that he considered himself cured and resumed active life as a sea-captain. He died 6 months after operation. As nearly as one can judge, the life of Finney's third case was prolonged as a result of 3 operations, although he lived but 11 weeks after the first operation. His fourth case is still living with great improvement in his subjective symptoms.

Death was probably hastened in the remaining ten cases: Barwell, 7 days; Roosevelt, 23 days; Abbe, 2 days; Kerr, first case, 18 days; Stewart's first and third cases, 9 and 5 days respectively; Halsted, 2 days; Finney, first case, 20 days; Corson, 2 days; Reeves, 24 hours.

Clinical and post-mortem evidence points to the efficacy of this method. Its great drawback is the difficulty of accurate diagnosis. If we consider that none of these cases were picked as being favorable for operation; but, on the contrary, that they were almost without exception considered hopeless cases, I think we are forced to give the method careful consideration. The fact that the method is still in its infancy and in many instances most crudely applied makes the record still more impressive.

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15. Litten: Virchow's Archiv, 1875, Vol. LXIII.

Discussion.

Dr. Osler.—Demonstration of Dr. Finney's third case (Case XXII) after his first operation. On admission this man presented a very remarkable picture. He had a pulsating area in the inframammary region close to the sternum, and a right-sided effusion. We were in some doubt at first whether it was not a case of pulsating pleurisy, but the pulsation persisted after withdrawal of the liquid and it gradually became more localized, and began to project. There was a loud bruit over it, which was transmitted to the back. Dr. Finney wired it and since the operation the local condition has improved. The redness has disappeared, and the impression of both heart shocks, the systolic and diastolic, which could be felt upon the slightest touch of the finger, is no longer present. The tumor has become harder and altogether the signs indicate that there is coagulation going on in the sac.

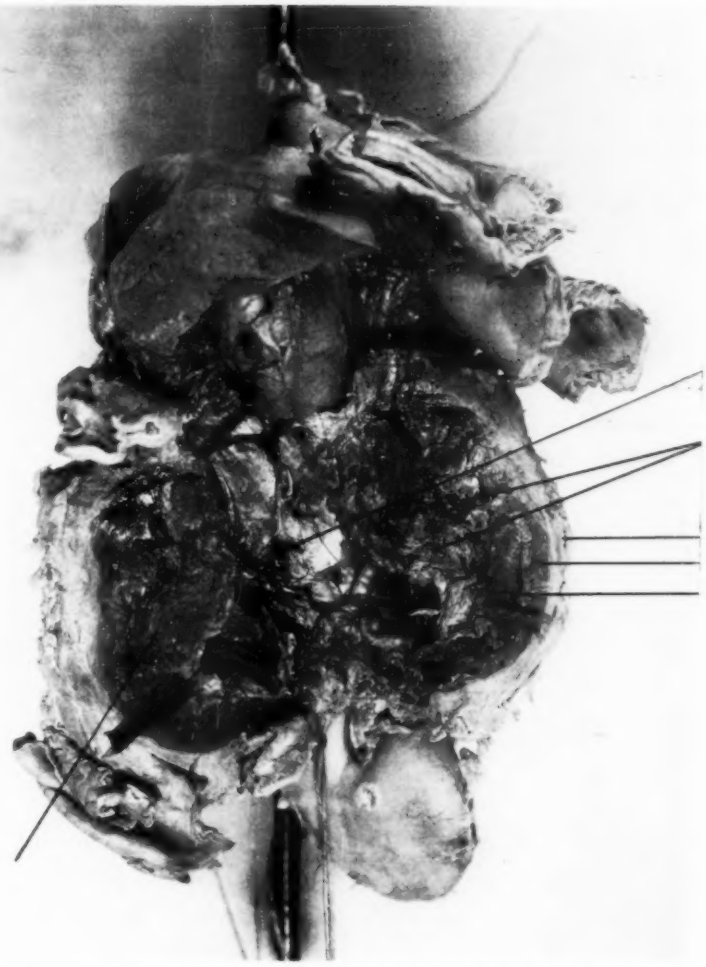
Dr. Finney.—The fifth case of Dr. Stewart's was a patient of Dr. John Neff, of Baltimore, whom I had seen in consultation. We had arranged to have him enter the hospital here for wiring, when some kind friend, very wisely no doubt, advised him to go to Philadelphia to Dr. Stewart. He has operated upon him three times with temporary benefit, after each operation. As Dr. Neff is present, perhaps he can tell us something about the case.

Dr. Neff.—I shall be very glad to furnish what information I have of the case. This gentleman's trouble was detected about three years ago and he was given a thorough iodid treatment with as much rest as we could enforce. There was some benefit resulting and he resumed his occupa-

a Extreme peripheral wall—compact fibrous portion—showing, in different regions, incorporation of nerve elements, blood vessels—thrombosed and patent, lymph glands and vessels, fat tissue.

b Looser red portion of wall, showing the same tissues as (*a*) being separated by the blood elements.

C Newly formed clot with wire zone in center, opposite the letter *c*.



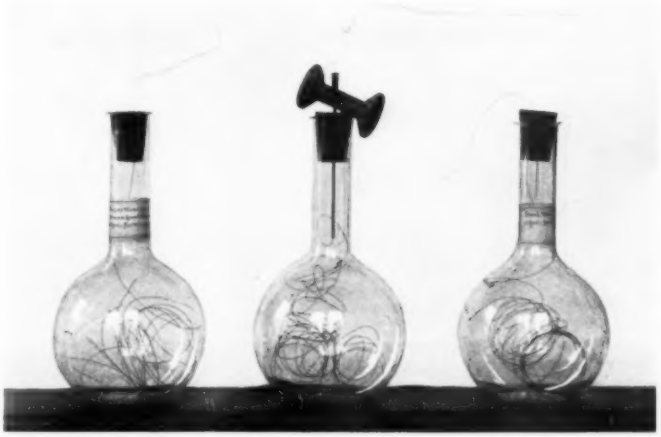
Dilated mouth of sup. mes. artery.

C Newly formed clot with wire zone in center.

A Whitish fibrous portion. } False arterial wall.
B Red portion. }

Wire ends.

Aneurism—Fusiform—Superior Mesenteric Artery. Path. No. 1144.



1. 2. 3.

1. 9 ft. pure silver wire. Drawn from No. 8 to No. 27.
2. 11 ft. silver (copper alloy $\frac{75}{1000}$) wire. Drawn from No. 8 to No. 27.
3. 11 ft. steel wire.

Each boiled on its spool for 15 minutes and then passed through cannula. Note the closer coil of 2.

tion, that of traveling salesman, again, but after a while came back worse, and I advised an operation, as I had read the report of Dr. Stewart's cases. He had some relatives in Philadelphia who advised him to consult Dr. Stewart, because he had done so many of these operations. I was present at the operation and Dr. Stewart introduced 12 feet of wire. The evidences of clot were very manifest, and you could not hear the bruit so directly in front as before the operation. He was subjected to a very rigid diet and absolute rest, remaining on his back for four weeks, not even elevating his head, and ice was applied over the region of the aneurism. At the end of that time he was allowed to walk around carefully but was kept in the hospital 8 weeks longer.

He seemed considerably benefited when he came home, but after awhile there appeared another point of protrusion and he went back for another operation. He remained under observation for one month, and then, another protrusion presenting itself, he was again operated on. I saw him only last week, just before starting for Philadelphia, expecting to have to be operated upon again, as there are two protrusions now. He is suffering from pressure on the trachea, also, and cannot take anything but liquid food. I do not believe he can live very long in the condition in which I saw him last, and I do not see how anything can be done now that will prolong his life to any extent. He had suffered intense pain before the first operation, but while the suffering has been ameliorated there has been no permanent success attending the operations.

DR. OSLER.—Aneurism of the aorta is so hopeless that it is very encouraging to hear Dr. Hunner's paper, particularly on the question of increasing the perfection of the technique. In the natural method of cure in aneurism gradual depositions of fibrin take place at the surface of the sac, and with a perfect technique, entailing a minimum of risk, repeated operations could be performed.

OBSTETRICAL PARALYSIS, INFANTILE AND MATERNAL.[1]

BY H. M. THOMAS, M. D.,

Clinical Professor of Neurology, Johns Hopkins University: Neurologist, The Johns Hopkins Hospital and Dispensary.

The force which is required to complete the act of parturition is, at times, a source of danger to the peripheral nerves of both the mother and child. It is to some of these traumatic cases of obstetrical paralysis that I wish to refer in this communication.

I have seen five such cases during the present year. Two occurred in mothers and three in babies; in one instance a mother and baby were paralyzed at the same labor.

This experience, which was unusual to me, interested me in these cases, and I trust that a short abstract of the histories may not be out of place at this meeting.

Duchenne's obstetrical paralysis of the arm in infants is not very uncommon and we are all familiar with its characteristics. Much has been written about it, and I should not presume to speak of it here were it not that some recent work has been done on the subject from the standpoint of the obstetrician that may be as new to some of you as it was to me.

Before referring more fully to this recent work, I shall give as a standard of contrast a free translation of Duchenne's conclusions.[2]

"Certain violent obstetrical measures, which may be necessary during the difficult lowering of the arm after the body of the infant has been born, or the strong traction on the shoulder by a finger introduced in the shape of a hook into the axilla, after the head has been born, may at times produce a paralysis of the arm, localized in the deltoid, the infraspinatus and the flexors of the forearm and characterized by the falling of the arm close to the side of the body, the rotation of the arm inwards and the extension of the forearm on the arm. The prognosis of this paralysis is, in general, grave; it may be cured by local faradization, but if this is abandoned, it becomes incurable and produces atrophy of the member."

Erb[3] speaks of the similarity of the cases described by Duchenne to those in which the brachial plexus is injured in adults. He confirms Duchenne's clinical picture and points out that the injury is to the 5th and 6th cervical roots, probably at the point in the neck, the stimulation of which by the electrical current causes a contraction of the muscles involved in this form of paralysis. This, the often-called Erb's point, he describes more accurately in his Handbuch der Elecktrotherapie, 2d edition, 1886, p. 305.

"A point can be discovered from 2 to 3 cm. above the clavicle and somewhat outwards from the posterior border of the sternocleidomastoid muscle, and just in front of the transverse process of the 6th cervical vertebra, the stimulation of which causes a simultaneous contraction of the deltoid, biceps, brachialis internus and supinator longus muscles (apparently usually also of the infraspinatus and subscapularis)."

Erb thought that the plexus might be injured by many forcible obstetrical procedures, but he blamed particularly the so-called "Prager Handgriff," in which the finger is placed above the clavicle and pressure made directly over the point that he described.

After this it was generally believed and taught that this form of paralysis was due to pressure on the brachial plexus at Erb's point. Why such varying conditions as are known to produce the paralysis should always make pressure at just this point, was not explained.

[1] Written for the American Neurological Association, 1900.

[2] De L'electrisation localisse. 3d edition. 1872, p. 361.

[3] Ziemssen's Handbuch. Bd. XII. 1ste Hälfte, 2te Auflage, 1876, p. 529.

C. F. Carter[4] advanced, for the first time, the theory that the stretching of the upper roots of the plexus and not pressure on the plexus, in the great majority of cases, was the cause of these obstetrical paralyses. He arrived at this conclusion from his inability to explain the cases by any of the accepted hypotheses, and not from any dissections or experiments.

G. L. Walton[5] in his interesting paper on the Etiology of Obstetrical Paralysis, speaks of the unsatisfactory character of the explanations of the causes of this paralysis. Carter's theory he considers the best, although he would expect paralysis of the pectoralis major, if the plexus were injured where Carter supposed; but, on the other hand, if the plexus were injured by pressure against the clavicle, as Oppenheim supposed, the scapular muscles ought not to be affected.

Walton dissected the brachial plexus and found that the suprascapular nerve is given off high up and runs independently; so he thinks it must be injured separately, probably by pressure either against the suprascapular notch, or against the outer edge of the scapular spine.

Walton lays stress on rotation of the child's head combined with traction, as an important factor in the production of these paralyses. He, in association with Dr. J. J. Thomas, made some experiments, which for some reason were not conclusive, except in one regard, which I quote from the original:

"One point of interest we have established, however; namely, that when the body is placed in the position suggested, with the face rotated and the head forcibly drawn away from the shoulder, the clavicle is brought up sharply against the dorsal curve of the first rib. This point of contact is, therefore, the probable seat of injury of the brachial plexus, excepting the suprascapular branch."

If I have understood Dr. Walton rightly, his belief is that the nerves are stretched against some resisting point, the edge of the clavicle, and the suprascapular notch for instance, and so injured.

Fieux,[6] in 1897, apparently without knowledge of the work that had been done in Boston, laid great stress on the stretching of the brachial plexus as the cause of this paralysis. He made dissections and experiments to show that it was the upper roots of the plexus that were most stretched, and particularly so when the head was bent laterally. Indeed, he was able by this maneuver to actually rupture the 5th and 6th cervical roots.

Fieux thought that the experiments that he did, showed that it was impossible to constrict the plexus betweeen the clavicle and the spinal column, or to injure the nerves by the application of forceps.

He will not admit that any other factor takes part in the causation of obstetrical paralyses, and explains them all by an undue traction on the neck with lateral flexion.

Cibert,[7] in an excellent thesis, written in the same year, but after the publication of Fieux's article, reviews the whole subject and gives many references to literature. He refers to Carter's, Walton's and Fieux's papers, and accepts the theory of stretching as explaining the great majority of cases. He is, however, not so positive as Fieux in his statement that traction on the upper roots of the brachial plexus is the only possible cause of such paralyses. Cibert concludes his article with an excellent table of seventy-six cases which he found in literature.

Schoemaker of Nymwegen,[8] after a short report of two cases of obstetrical paralysis, reviews the subject, especially in relation to Fieux's article. He repeats the experiments made by this author, and, for the most part, confirms his results. Schoemaker found that if the neck be stretched in the direction of the axis of the body, the upper roots of the brachial plexus are put upon a certain amount of tension; that if during the traction the head be bent forward or backward or rotated, this tension is not materially increased; but if the head be bent laterally, the tension becomes very much greater, the fifth root being most stretched, the sixth next, the seventh and eighth much less. Schoemaker was not able to rupture the fifth and sixth roots in the alcoholic specimen.

He was able to constrict the 5th and 6th roots of the plexus by compressing the shoulders and pressing them upwards. This was more easily done if the arms were elevated above the head. The constriction occurred between the clavicle and the transverse process of the sixth cervicle vertebra. It was so great as to make an indentation in the nerve roots. With forceps he found that it was not easy to compress Erb's point; indeed, he believes that it is not possible if the forceps are applied nearly in the direction of the axis of the body, but that it may be done if the forceps are applied at an angle of about 30 degrees. That the finger of the obstetrician may at times injure the brachial plexus at Erb's point he thinks is possible, although he believes it must occur very rarely.

Schoemaker shows how these various conditions may occur during labor, thus: In head presentations, the first danger is from pressure by the clavicles. This is slight, except in the few cases in which the shoulders are compressed and pressed towards the head. When the head is born then it is possible with the woman on her back, and the head hanging over the perineum, that the plexus may be so stretched as to be injured. If the head is grasped and traction is made with the head bent toward one shoulder, there is then great danger of overstretching the plexus. If the shoulders are still not born, and the finger is put in the axilla, and strong traction made, then it is possible that the clavicle may be raised and compress the plexus against the spinal column.

In cases in which it is necessary to use forceps, Schoemaker thinks that the danger here is also from stretching the plexus, although he admits that in certain cases the forceps themselves may injure the nerves. Very strong traction in the axis of the body may cause such a stretching as to injure the

[4] Boston Medical and Surgical Journal, May 4, 1893.
[5] Boston Medical and Surgical Journal, Dec. 24, 1896.
[6] Annales de Gynécol., Tome XLVII, 1897, p. 52.
[7] Lyon Thesis, 1897.
[8] Zeitschrift f. Geburtshülfe u. Gynaekologie, Bd. XLI, Heft 1, 1899, p. 33.

nerves, although this is much more apt to occur when the head is bent laterally.

In breech presentations, the shoulders are often constricted and pressed towards the head, and it is in these cases that the plexus is most apt to be constricted between the clavicle and the spinal column. The danger is greatest when traction is made on the body and the arms are above the head. If the arms are born and traction is made by the fingers above the clavicles to deliver the head, it is possible to injure the plexus by direct pressure, but here again Schoemaker thinks that the chief danger is in stretching the nerve roots.

He finds in literature ninety-five cases of typical Duchenne paralysis in which the mechanism of labor is more or less accurately determined. Sixty-six of these cases he takes from Cibert's theses.

Of these ninety-five cases, fifty-five were head presentations. In ten of these labor was spontaneous; eight times the head was pulled upon with lateral flexion; ten times it was necessary to make traction with a finger in the axilla. In twenty-eight cases forceps were applied.

In forty cases the breech presented. In six of these the birth was spontaneous, but in thirty-four the child had to be extracted; of these last one or both arms were noted as being raised in thirteen cases.

Schoemaker thinks that if the dangers which occur at the various stages of labor are recognized, and the proper procedures are taken to meet them, very few cases of obstetrical palsy will occur.

From the neurological standpoint, the chief interest in these paralyses is the grouping of the muscles which are affected. Why should an injury to the brachial plexus cause a paralysis which is limited to just these muscles, the infraspinatus, the deltoid, the supraspinatus, the biceps, the brachialis and the supinator longus? These muscles are supplied from various nerves which in their turn arise from different cords of the plexus. It is difficult to imagine any point in the plexus an injury to which would cause such a paralysis. Erb recognized this and supposed that the lesion was to the 5th and 6th cervical roots, and that it was the stimulation of these roots at the so-called Erb's point that caused the contraction of the muscles named.

The 5th and 6th cervical roots, however, send fibers to many other muscles than those paralyzed in these cases; and, on the other hand, these muscles receive fibers from other roots. A reference to Wichmann's[9] recent work will show how complicated the problem is and what very different views are held by the different investigators in this line.

It would seem to me that, although all muscles receive fibres from several spinal roots, that their movements are represented particularly in one or two roots, and that an injury of these special roots causes a paralysis of those muscles which are most represented in them. It seems fairly well determined that the muscles affected in obstetrical palsy have their chief representation in the 5th and 6th cervical roots, and the experiments of Fieux and Schoemaker show that these roots are most apt to be injured during difficult labor, whether it is simply by the stretching of the plexus, or the squeezing of it between the clavicle and spinal column.

What are needed to clear up the question are careful post-mortem examinations, for we are almost completely without such data. Nonne[10] reports the examination of a case in which the roots of the plexus were pressed upon by a tuberculous growth and in which paralysis of characteristic distribution resulted. Oppenheim[11] refers to having examined a case of obstetrical paralysis in which there was degeneration of the 5th and 6th cervical roots. These two cases, as far as I know, are the only ones in which autopsies have been made, and they do not settle many of the points in dispute.

The cases which I wish to report are the following:

CASE I.—Johns Hopkins Hospital, Dis. Nerv. System, No. 10,465. Bernard C. Six weeks old. Is brought on account of his not using right arm. Mother has had four other children and three miscarriages.

Birth was at term. The labor began at six p. m., the head presenting. Chloroform was administered at 11 p. m., and the forceps were applied. After the birth of the head, which offered considerable difficulty, quite a long time elapsed before the birth of the shoulder. The right arm was born first and traction was made on it. Labor was complete at 2 a. m. The paralysis of arm was noticed soon after birth. (History obtained from grandmother.)

P. C. The right arm is held at side, the elbow is extended and the arm is rotated inward. There is no evidence of a fracture or a dislocation.

The muscles paralyzed are the deltoid and supraspinatus, the flexors of elbow and the infraspinatus.

The electrical examination shows a slow lazy response of the paralyzed muscles to a weak galvanic current.

This patient was found dead in bed with his mother when about nine weeks old. No improvement had resulted from the use of the galvanic current. We were not notified of the child's death for several days and no autopsy was made.

The second case I saw in consultation, and it illustrates very well the danger of strong traction on the head with lateral flexion of the neck. The notes which the attending physician has kindly sent me are as follows:

CASE II.—"The record I have in the case of Mrs. K. is as follows: 38 years old, 4 children, labors and puerperia always perfectly normal. Nothing of note as to present pregnancy. Labor occurred Nov. 21, 1899. Child in R. O. I. T. (*i. e.*, head present, back to the mother's right). Labor was perfectly normal up to the delivery of the head. External rotation of the occiput took place to the mother's right, thus bringing the bisacromial diameter of the child into the anteroposterior diameter of the pubes, with the left shoulder of the child under the symphysis and the right in the hollow of the sacrum. Labor was now arrested by the inability of the uterus to force the shoulders through the pelvis, and in order to save the child it was thought best to extract at once. This was done by grasping the head by the occiput and chin, and depressing it until the anterior shoulder slipped under the symphysis, when, by elevating the head, the other shoulder and body were delivered without much trouble.

[9] Die Rückenmarksnerven und ihre Segmentbezüge, Berlin, 1900.

[10] Deut. Arch. f. Klin. Med., Bd. XL, 1896, p. 62.

[11] Lehrbuch der Nervenkrankheiten, 2d edition, 1898, p. 320.

"It was necessary to make strong traction on the neck of the child to free the anterior shoulder, and in this maneuver the brachial plexus on the left side was probably stretched.

"The cause of the dystocia lay in the size of the child, the mother's pelvis being perfectly normal, 22.5, 28, 34, and 20.5."

I saw the baby first on Nov. 29. It was a remarkably strong and active child. The left arm hung to the side with elbow extended and extreme inward rotation. Movements of fingers and of wrist were retained. Extension of elbow was strong, while there was no evidence of any action in the flexors. The shoulder could not be abducted nor the arm rotated outward. There was paralysis of the deltoid, the supraspinatus, the infraspinatus, the biceps, the brachialis and the supinator longus. The electrical examination was not conclusive, as I was unable to get any response either in the well or the paralyzed arm with any strength of current that I thought it advisable to use. A hopeful prognosis was given and the nurse was told to use gentle friction.

The child was seen again on Jan. 5, when a little more than 6 weeks old. The condition then was practically the same as before. Persistent passive motion combined with massage of the affected muscle was advised and the arm was galvanized about once a week upon the occasion of my visits. I was never able to determine the reaction of degeneration. The improvement began at once and was first noticed in the flexors of the elbow, then in the deltoid and finally in the outward rotation of the arm. The child was seen for the last time on Feb. 9, and was then practically well.

CASE III.—J. H. H., Dis. Nerv. Syst., No. 10,804.

Maggie C., 8 weeks old. Patient is brought by mother, who is under treatment for obstetrical paralysis of legs (Case V). The child's left arm has been paralyzed since birth.

The patient is the first child and is said to have weighed 12½ lbs. at birth. The mother has a contracted pelvis.

The labor was at term and was very difficult. The head presented. Forceps were used and had to be readjusted 6 or 7 times before the head was born; the shoulders then became fixed and traction was made on the head with the neck flexed towards the right shoulder. (The mother's sister, who gave the account of the labor, seems sure in regard to this.) The child did not breathe satisfactorily for some time after birth. There were bruises on the head and on the left side of the neck just below the ear.

P. C. There are no evident scars in neck. There is no fracture or dislocation about the shoulder joint. The left arm is held in the characteristic position, close to side, extended at elbow and rotated inwards. The wrist and fingers are moved voluntarily. The paralysis is of the deltoid, infraspinatus and flexors of the elbow. Electrical examination did not reveal the reaction of degeneration.

The child was ordered passive movements, massage and the galvanic current. The improvement was marked from the first, and the child, when seen last in June, 1900, was practically well.

In these three cases the head presented. Forceps were used twice. The cause of the injury to the brachial plexus can be determined definitely in only one case—the second. Here the only forcible procedure, in an otherwise easy labor, was traction on the head with strong lateral flexion of the neck, and the injury was surely due to stretching of the nerve roots. In the first case, where forceps were used to deliver the head, the right arm was next delivered and traction was made upon it, which may have elevated the clavicle so as to compress the roots between it and the vertebral column. It is also probable that traction was made on the head, thus stretching the plexus. In the third case, where forceps and great force had to be used to deliver the head, it is conceivable that the blades of the forceps may have pressed upon the plexus. But here again strong traction with lateral flexion of the head was necessary to deliver the shoulders, and it is probable that it was this procedure that produced the paralysis.

The result in the two cases that lived was very satisfactory, but unfortunately such is not always the case, and I have seen a number of cases that have persisted until adult life.

The prognosis must, of course, depend upon the severity of the injury.[12]

The nerves of the mother may also be injured by traumatism during labor. This has been recognized for a long time but the occurrence is not common and not much has been written about it. In books on obstetrics it is often not mentioned and in neurological books, traumatism during labor is usually simply included with the other causes of injury to the roots of the sacral plexus.

Lloyd,[13] however, has contributed an excellent chapter on the subject, and Mills[14] was one of the first to call attention to these cases. Hünermann,[15] from a review of the literature and a study of four cases in the obstetrical clinic at Berlin, determined that the paralysis resulting from trauma during labor nearly always had a definite distribution; *i. e.*, it affected exclusively or most intensely the muscles supplied by the external popliteal nerve. He explains this by the fact that this nerve receives its fibers mostly from the 4th and 5th lumbar roots and that these, after forming the lumbosacral cord, as they pass over the brim of the true pelvis to join the sacral plexus, lie next to the bone and are exposed to pressure, whereas the lower roots of the plexus lie on the pyriform muscle, and are more protected. The injury, he thought, was due to pressure of the head and not to the blade of the forceps.

Hünermann's view has been generally accepted, and but little has been added to the subject since his paper.

The histories of the two cases which I have under treatment are, in brief, as follows:

CASE IV.—J. H. H.—Disp. Nerv., No. 10,159.

Mrs. G., æt. 26. Admitted July 29, 1899. Complains of weakness of right leg following labor.

Family and personal history unimportant. The first confinement was normal. The present trouble she dates from the birth of her second child. She had been well during pregnancy and up to the time of labor, which took place May 10, 1899. The membranes were ruptured at 7 a. m., but as there were no labor pains, she ironed all the morning. The pains began at 1 p. m., but were not very strong. Between 3 and 4 she began to have severe pain in the back of her right leg, between the knee and hip; there were no muscular spasms. The labor not progressing, she was given chloroform at 9 p. m. and the child

[12] See Sach's excellent article on Prognosis and Treatment (Nervous Diseases of Children, p. 223).

[13] Twentieth Century Practice of Med. Vol. XI, 1897, p. 307.

[14] University Med. Mag., Vol. V, 1893, p. 508.

[15] Arch. f. Gynækol. Vol. XLII, 1892, p. 489.

was delivered by the aid of forceps. The child died soon after birth.

The patient slept that night but in the morning complained of severe pain through the whole right leg. The leg was paralyzed and felt numb. The pain in the leg persisted, and only gradually improved after she got about. The puerperal period seems to have been perfectly normal except for the pain and weakness in the leg. The patient got up on the 10th day and was able to walk with the aid of a cane. The strength of the leg has improved to some extent, and the pain has slowly passed away. It was never aggravated by the passage of a constipated stool. The leg has always felt numb and cold below the knee.

The records of the patient during July and August, when she was coming every day to the dispensary for electrical treatment, show, in abstract, that there was complete paralysis of the muscles supplied by the right external popliteal nerve, with a certain amount of weakness in the muscles of the calf, and the flexors of the knee on that side. There was typical reaction of degeneration in the distribution of the external popliteal nerve.

The right leg below the knee looked somewhat bluish and felt cold to the observer's hand. The contrast in this respect between the right and left leg was marked. There was a distinct dulling of sensation to touch, temperature and pain over the outer half of the leg below the knee (the cutaneous distribution of the external popliteal nerve). There was no complete anæsthesia.

The knee-kicks were active on both sides, the reflex from the tendo Achillis was absent on the right side, but present on the left. Plantar irritation caused a flexor response on both sides.

The patient has come faithfully for treatment and has improved to some extent. The improvement, however, has been in the power of the flexors of the knee and the calf muscles, and now, nearly a year after the injury, these muscles are fairly strong, although they are still weaker than the corresponding muscles of the left leg. There has been no return of power in the external popliteal muscles. The muscles about the hip are all strong.

There is considerable atrophy of the right leg below the knee, the measurements showing that this leg is from 3-4 cm. smaller in circumference than the left. The leg is not so cold as it was, and the dulling of sensation, although still present, is not so marked.

Dr. J. Whitridge Williams was kind enough to make a pelvic examination and he found (April, 1900) that the measurements were practically normal and that there was no evidence of an inflammatory condition anywhere in the pelvis.

CASE V.—J. H. H. Disp. Nerv. No. 10,784. Admitted March 24, 1900. Mrs. C., æt. 25. Complains of weakness and pains in leg following the birth of her child.

Nothing bearing on the present trouble is found in the family or personal history. The child, which was born when the patient was injured, has Duchenne's obstetrical palsy (Case III).

During her pregnancy, which was the first, the patient was well up to the seventh month, at which time she began to have some discomfort, with pains referred to the lower part of the abdomen and the front part of thighs.

The labor began at 4 a. m. on Friday, Feb. 2, 1900. The pains were severe and the physician who examined her at 10 a. m. thought that everything was satisfactory and that the labor would be soon completed. The pains, however, became weaker, and at 6 p. m. it was decided to use instruments. The head was presenting.

Up to this time she had had no pain in her leg. Chloroform was given and she was unconscious for nearly two hours. She has been told that the physician had great difficulty in delivering the child and that the forceps had to be re-applied six or seven times. Upon regaining consciousness she complained of great pain in her legs below the knees. She was given morphia and slept during the night. The next morning it was noticed that both of her legs were paralyzed; the weakness was at first widespread, but affected the left more than the right. The pain was also severe and persistent and localized in the legs below the knees.

The confinement after the labor was perfectly normal. The patient at no time had any fever.

After three days she began to regain power in her right leg, and this improvement has continued steadily up to the present time, and she now thinks that it is nearly well. The pain which was referred to this leg has grown less and less severe and now she complains only of a numb sensation in the toes. The left leg has also improved to some extent, both in regard to power and the pain which is felt in it.

The pain has always been exaggerated by pressure on the legs and by a passage of a constipated stool. She is often kept awake at night by disagreeable subjective sensations, paresthesia, etc.

The patient got out of bed on the 10th day, but could not walk for three days.

P. C. The patient is a small, delicate-looking woman. Nothing abnormal is noticed about the functions of the cerebral nerves or of the arms and chest.

The patient walks in a remarkable manner. With each step she leans toward the side, so as to bring the center of gravity over the foot that is on the ground, in a manner very suggestive of a case of muscular dystrophy. Combined with this, there is the slapping gait of double foot-drop. The disability is more of the left side.

Movements of hip-joint:

Flexion, strong on both sides.
Extension, somewhat weak, more so on left than right side.
Adduction, fairly strong on both sides.
Abduction, weak, more so on left side.
Rotation out, fairly strong.
Rotation in, perhaps a little weaker.

Movements of knee joint:

Extension, strong on both sides.
Flexion, fairly strong on right side, weak on left.

Movements of ankles:

Extension (plantar flexion) strong on right side, somewhat weaker on left.
Flexion, possible on right side, but these muscles have very little power and are unable to resist any force applied by the examiner to overcome them. No power on left side.

Movement of toes:

Flexion, good on the right side, feeble on left.
Extension, weak on right side, impossible on left.

Electrical examination shows the partial reaction of degeneration in the muscles supplied by the right external popliteal nerve, and the complete reaction of degeneration in the corresponding muscles of the left side. The other muscles show no qualitative changes.

Pressure over the muscles, particularly those on the anterior part of the lower leg, causes pain.

No objective sensory disturbances can be determined, and there is no particular coldness of the leg. There is some swelling over the back of the left foot.

The knee-jerks are active in both legs. The reflex from the tendo Achillis cannot be brought out. Stimulation of the plantar surfaces of the feet causes a flexor response of the toes.

Dr. Williams made a pelvic examination of the patient and sent me the following measurements:

"The patient has a moderately contracted pelvis, the measurements being as follows:

Distance between the anterior sup. spines of the ilium..22½ cm.
Distance between the iliac crests.....25
Distance between the trochanters 29
Diagonal conjugate 11
True conjugate ..... 9+
Baudalocque's diameter.....17.5

This is not a very marked degree of contraction, but with a large child may readily explain pressure upon certain nerves of the sacral plexus. The normal measurements are 26, 29, 32, 13 and 21 respectively, and you can readily see that there is a moderate degree of contraction in all diameters of the pelvis."

The patient has been treated with the galvanic current at the dispensary as often as she can come, and she has been directed to apply mild massage to the affected muscles when at home. She has improved considerably; the movements which were noted as weak have all improved in power to some extent. She is now (June, 1900), able to contract voluntarily certain of the muscles supplied by the left anterior popliteal nerve, although with not sufficient power to flex the ankle. Her walk has lost, to a great extent, its wabbling character. She no longer complains of pain.

These two cases are quite analagous and are, I think, good examples of injuries to the roots of the sacral plexus during labor (obstetrical paralysis of the mother).

In both cases the women had passed through a practically normal pregnancy. In both cases the labor was difficult and instruments had to be used. In the first case the pelvis was normal and the child was large; in the second, the pelvis was generally contracted and the child was very large (12½ lbs.).

In the first case there were symptoms that the nerve roots were being compressed (pain in the distribution of the sciatic) before there was any instrumental interference; in the other case there were no such symptoms.

In both cases some pain was complained of directly after the women came from under the influence of anæsthetics and narcotics, and in both the paralysis was noticed at once.

The puerperium appears to have been normal in both cases, the women both getting up on the tenth day.

The paralysis reached its height at once in both women and improved to a certain degreee in each case.

In the first case the right leg was alone affected, while in the second case both legs were paralyzed. The paralysis was most marked in the muscles supplied by the external popliteal nerve (the flexors of the ankle and the extensors of the toes); and, indeed, the only absolute paralysis was confined to this distribution. There was, however, a certain amount of weakness in the other muscles supplied by the sciatic nerve. In the second case there was weakness of certain of the movements of the hip joint, particularly abduction (gluteus medius), and to a less degree, extension (gluteus maximus) and inward rotation (gluteus medius), while in the first case no such weakness could be determined.

Electrical changes were demonstrated in the paralyzed muscles in both patients.

Pain was a prominent symptom in both of the cases; this was most intense at first and gradually subsided; it was localized on the outer side of the leg below the knee and on the back of the foot.

Paresthesia and other subjective sensory disturbances were complained of. An objective dulling of the different sense qualities in the distribution of the cutaneous branch of the external popliteal was determined in the first case; no such disturbance could be found in the other. Vasomotor changes (coldness and blueness of the leg) were marked in the first case but were not noticeably present in the second.

Other than atrophy of the paralyzed muscles, no trophic changes were noticed in either case.

The knee-kicks were active in both cases, but the ankle-jerk could not be obtained on the right side in the first case nor on either side in the second, where both legs were affected. Plantar stimulation caused a flexor response in both women.

In the first case there is, after nearly a year's treatment, a complete paralysis of the flexors of the ankle, while in the second case, when the paralysis was much more wide-spread at first, there is some return of power in all the movements, after sixteen weeks.

These cases correspond closely to those which have been already recorded, but it may be well to refer particularly to one or two points which are somewhat unusual: Pain was a more pronounced symptom in our cases than would be expected from the description that is often given of this type of paralysis. A paralysis of both legs, as in the second case, *is a very unusual occurrence, and I have not seen a description of a similar case;* when it is remembered that, at the same labor, the baby's arm was also paralyzed, the occurrence seems still more remarkable.

In this case the weakness of the glutei, especially the gluteus medius should also be noticed. This gave to the walk its peculiar wabbling character. One would expect that these muscles would be more often paralyzed than the published records indicate, as they receive their nervous supply from the upper part of the sacral plexus.

That the cases which I have described were due to trauma of the roots of the sacral plexus, received during labor, seems to me to require no demonstration. I do not see what other hypothesis can explain the development, distribution and course of the paralysis.

We have not sufficient data to explain why there should have been undue pressure on the nerves in the case of the first woman except that the labor was difficult and protracted. Her pelvis is of normal size and shape. There was probably some abnormality in regard to the presentation, which if it had been recognized might have explained the injury.

In the second woman the conditions were just those that Hünermann believed to be most favorable for the production of these paralyses; *i. e.*, a generally contracted pelvis and a large child. That the nerves were injured on both sides of the pelvis, may have been due to the fact that the forceps were reapplied several times and to the possibility that during these procedures the position of the head was altered and pressure was made first on one side and afterwards on the other.

In explaining the distribution of the paralysis, authors have generally accepted Hünermann's theory, that the injury is particularly to the lumbosacral cord on account of its ex-

posed position, and that from this cord the external popliteal nerve receives most of its nerve fibers.

But here again the conditions are not so simple as this would indicate. It is true that the lumbosacral cord does occupy an exposed position as it lies next the bone on the innominate line, and protected from pressure only by the blood-vessels which lie over it. This cord, however, sends fibers to the internal as well as to the external popliteal, and the latter nerve receives fibers from the first and second sacral roots, as well as from the lumbosacral cord. Dr. C. R. Bardeen, Associate in Anatomy Johns Hopkins University, has tabulated the actual condition found in about 200 dissections of the sacral plexus, made in the Anatomical Laboratory. Through the courtesy of Dr. Bardeen I am able to give some of his results in advance of their detailed publication. He finds it not unusual to have the external and internal popliteal nerves entirely separated up to their origin from the plexus (in about 10 per cent), and that in all cases it is easy to separate them with very little injury.

The common formation of the external popliteal nerve is from the fourth and fifth lumbar and the first and second sacral nerves (60.5 per cent). The common formation of the internal popliteal nerve is from the fourth and fifth lumbar and the first three sacral nerves (64.5 per cent). The following table illustrates in concise form the results found in 127 plexuses.

TABLE SHOWING THE GROUPS OF SPINAL NERVES WHICH CONTRIBUTED TO THE TIBIAL AND PERONEAL NERVES IN 127 INSTANCES.

Group of spinal nerves contributing.	Peroneal nerve.		Tibial nerve.	
	No. of inst.	Per cent.	No. of inst.	Per cent.
23d–26th (3l–1s)	1	.8		
23d–27th (3l–2s)	3	2.4		
24th–25th (4l–5l)	1	.8		
24th–26th (4l–1s)	30	23.6	1	.8
24th–27th (4l–2s)	77	60.5	18	14.2
24th–28th (4l–3s)	3	2.4	82	64.5
24th–29th (4l–4s)			10	7.9
25th–27th (5l–2s)	9	7.		
25th–28th (5l–3s)	3	2.4	10	7.9
25th–29th (5l–4s)			6	4.7
	127	99.9	127	100.0

In this table it will be noted that there is found at times a considerable variation from the normal origin of the peroneal and tibial nerves. In some instances a group of nerves more anteriorly situated, in some a group of nerves more posteriorly situated than normal, contributes to their formation. When a more anterior or a more posterior group of nerves than the normal contributes to the external and internal popliteal nerves, there is usually found at the same time an alteration in the relative position of the pelvis, so that the roots of the limb nerves have relations to the pelvis approximately similar to that which they have in normal conditions.

In most instances the peroneal nerve receives the bulk of its fibers from the fifth lumbar and first sacral nerves, and the tibial the bulk of its fibers from the first and second sacral nerves.

If one consults Wichmann's[16] monograph, it will be seen what a great number of muscles he finds represented in each of the roots that form the sacral plexus: 32 in the 4th lumbar, 33 in the 5th, 42 in the 1st sacral, etc., etc., each muscle being represented in from two to four roots.

All that can be said is that, on the whole, the muscles supplied by the external popliteal nerve are represented higher in the plexus than those supplied by the internal popliteal (lumbar IV-V, sacral I for the first and lumbar V to sacral I and II for the second).

It is not easy to understand how an injury to the lumbosacral cord (*i. e.* the fourth and fifth lumbar roots), could cause a motor and sensory paralysis so sharply limited to the distribution of the external popliteal nerve, as often occurs in obstetrical paralyses (our first case).

Dr. Bardeen has suggested as a possible explanation the fact that the branches of the roots that go to form the external popliteal nerve are given off from the dorsal aspect of the plexus[17] and lie next to the bone, while those forming the internal popliteal lie on them, and that, therefore, these dorsal offsets would be apt to be injured.

With this addition to Hünemann's theory we might state the explanation as follows: *The upper roots of the sacral plexus do not lie upon the pyriform muscle, but against the bony wall of the pelvis, and are thus exposed to injury from pressure during certain difficult labors. It is the dorsal offsets of these roots which lie against the bone and which receive the chief injury. The external popliteal nerve is made up from these dorsal offsets, and therefore the paralysis is chiefly localized in the distribution of this nerve.*

The superior gluteal nerve supplying the gluteus medius and minimus muscles and the inferior gluteal nerve supplying the gluteus maximus also receive their nerve fibers from the dorsal division of the roots of the plexus, and it is interesting to note that these muscles are not infrequently paralyzed in obstetrical paralysis. Our second case is an example of this.

Although it seems clear to me that these cases are due to trauma of the nerve-roots during labor, the view has not been universally accepted. Lloyd[18] considers the question fully and concludes as follows:

"From the facts and authorities already cited, it is evident that there is some latitude for differences of opinion as to the exact causation of lesions of the sacral plexus and its chief trunks during labor. The older writers were evidently disposed to regard pressure by the head and injuries by the forceps in prolonged and difficult labor as important factors in causing these paralyses. The tendency of more modern writers is to dissent from this view, and to ascribe lesions of the sacral plexus and its branches to a septic inflammation, propagated directly to the nerve trunks from a metritis or a periuterine cellulitis. I do not see that it is necessary to ignore either one or other of these important factors, although I believe that the theory of septic infection is one that more satisfactorily explains the

[16] Die Rückenmarksnerven und ihre Segmentbezüge, Berlin, 1900.

[17] See the excellent figure in Quain's Anatomy, Vol. III, pt. II, 1895, p. 324.

[18] Op. cit., p. 313.

majority of these cases. There can be little doubt, however, that in case of a large head or a contracted pelvis, the instruments, especially if applied in a faulty manner, might make pressure upon the sacral plexus where it lies upon the body of the pyriform muscle, or especially upon the trunk of the sciatic nerve where it emerges below the lower margin of that muscle, and where, by reason of its great size and its exposed position, it is liable to injury."

That the nerves may be involved in inflammatory conditions of the pelvis to such an extent as to cause paralysis is very generally stated upon good authority, but personally I have had no experience with such cases. They must be unusual for I have been unable to find the record of such a case in Dr. Howard A. Kelly's very active gynæcological service. No such case has been referred to the neurological department for examination, and neither Dr. Kelly nor any of his associates can remember such a case. It may also be added that we have not seen a paralysis due to the involvement of the nerves during the growth of a pelvic tumor, which seems remarkable when one reads the statements in textbooks.

A good deal of the confusion is due to the habit of classing together all cases of paralysis which develop during the puerperal state under such general names as "puerperal paralysis" or "puerperal neuritis." This is manifestly a mistake as there are several conditions occurring during labor and confinement which cause paralysis.

Windscheit,[19] under the title "Neuritis gravidarum und Neuritis puerperalis," gives a very interesting summary of the different conditions which may be classed under the term neuritis. He divides puerperal neuritis into four classes:

1. Certain cases which had developed during pregnancy (neuritis gravidarum) and have persisted after confinement. The etiology of these rare cases is not known, but they are supposed to be due to the action of some poison circulating in the blood. The clinical picture is usually that of the pure motor form of neuritis. No especial nerves are liable to be affected. There is a gradual weakness of the different nerves of the extremities; the muscles atrophy and show the reaction of degeneration; trophic changes occur. The nerve trunks are sensitive to pressure. Slight sensory changes may be present. Pain is not frequently complained of.

2. Neuritis due to puerperal infection. Here the neuritis is purely local, due to the extension of the inflammatory exudates, so as to involve the pelvic nerve. Such cases have been recognized for a long time. He refers to von Leyden[20] but gives no other references. Under this head he also classes those cases following general pyemia, in which all the nerves of the body may be affected and not alone those of the lower extremities.

3. Puerperal neuritis due to traumatic injury during labor. To this group the cases which I have described belong. Windscheit has no doubt as to their cause, for he says "Es handelt sich hier um rein mechanische Momente."

[19] Sammlung Zwanglosen Abhandlungen aus dem Gebiete der Frauenheilkunde u. Geburtshülfe, v. Max Graefe, Bd. II, 1899.

[20] Charité Annalen, 1862.

4. Puerperal neuritis (Moebius). Under this head are grouped those peculiar cases first described by Moebius[21] and afterwards by other observers, especially Eulenberg.[22] These cases develop in women in whom pregnancy and confinement have been perfectly normal, and in whom there have been no other diseases from which the neuritis could have developed. Two forms are distinguished (Eulenberg):

(*a*) The localized form. In this form only one or two nerves are affected. In the arm the median and the ulnar—the arm type. In the leg the crural—the leg type. Other nerves have also been found diseased, even the optic nerve. In these nerves there develops very soon after an entirely normal confinement, a paralysis with atrophy of the muscles and the reaction of degeneration. There is seldom any pain or objective sensory disturbance. The prognosis is not entirely good. Recovery may take place, but there have been more cases described in which this did not occur.

(*b*) The generalized form. In this the paralysis develops in many nerves at the same time, and often after the manner of Landry's paralysis; *i. e.*, the ascending type. The cranial nerves have also beeen described as affected. In these cases the prognosis is still graver than in the localized form, and death has occurred from the involvement of the respiratory nerves.

The cause of these cases is not known. Here again, as in the neuritis of pregnancy, some unknown toxic agent has been blamed. It has also been thought that the anemia following hemorrhage may have been the cause. Strong antiseptic douches have also been blamed.

It would seem to me to add clearness if the name puerperal neuritis were used to designate those cases classed in the fourth group. These cases are peculiar to the puerperal state, and as yet we know of no cause for them other than certain indefinite abnormalities dependent upon this state. It is probable that in this group there are cases belonging to different categories and that future examination will distinguish them. At present this does not seem possible, and they may well be classed together under the term "puerperal neuritis."

In regard to the other three groups, we have only to consider the second and third, for there is no reason to distinguish the first group from cases occurring in pregnancy (neuritis of pregnancy).

In the second group are the septic cases which seem only peculiar to the puerperal state in the time of the infection. The name *septic neuritis* (puerperal), with the qualifying subtitles, (*a*) local; (*b*) general, would seem to distinguish these cases.

In the remaining group, the third, are those cases which are believed to be due simply to trauma of the pelvic nerves during labor. This group might be named *traumatic puerperal neuritis*, if one classed every paralysis due to traumatic injury of nerves as a neuritis. This is not usually done, and the distinction between traumatic paralysis and traumatic neuritis is largely a matter of individual choice. It would,

[21] Münchener med. Wochenschrift, 1887, No. 9.

[22] Deutsch. med. Wochenschrift, 1895, Nr. 8 u. 9.

however, seem wise to distinguish these cases by a name that calls particular attention to the manner of their production. Duchenne called the paralysis of the baby's arm due to injuries of the nerve received during birth, *infantile obstetrical palsy*, or birth palsy. I would suggest that cases of paralysis occurring in women due to injury during labor be also called *obstetrical paralysis*, and that the adjectives *infantile* and *maternal* be used to distinguish the two conditions: Thus *infantile obstetrical paralysis* (Duchenne), or obstetrical paralysis of the infant; and *maternal obstetrical paralysis*, or obstetrical paralysis of the mother.

In this way emphasis is laid on the causes of these conditions, which being borne in mind, measures are more apt to be taken to prevent trauma during labor.

Schoemaker [23] tried to show how obstetricians should guard against injury of the brachial plexus of the child, and Huber [24] explains how he believes the nerves of the mother can best be protected.

This is an obstetrical question the full discussion of which would be out of place at the present time by the speaker. I shall endeavor, however, to summarize in a few sentences Huber's chief conclusions.

He believes that the birth itself is responsible for most cases of puerperal neuritis (a name which he uses in a very general sense), and that the physician should be on his guard against dangers occurring at this time. The chief danger is the undue pressure of the child's head on the nerves of the pelvis, which is more apt to occur the greater the disproportion between the size of the head and that of the mother's pelvis, and the longer the pressure is continued. He therefore says that the labor should not be allowed to continue longer than is absolutely necessary; that, if it halts, instruments should be used if the soft parts are sufficiently dilated. He is careful to state that this interference should be undertaken only under the strictest obstetrical rules; for, if these be disregarded, more harm may be done than if no interference were made. Badly applied forceps may themselves injure the nerves. He advises the early administration of chloroform to relax the muscles of the pelvis and to increase the available space. He has never seen any harm come from its administration but only good. He cautions against the too zealous employment of hydrotherapeutic measures directly after labor, and he thinks, for instance, that a cold sitz-bath at this time may cause an inflammatory condition of the nerves.

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OXYGEN AND STEAM WITH THE VAPORS OF A SPECIAL INHALATION MIXTURE IN PULMONARY DISEASES.[1]

By Clement A. Penrose, M. D.

At a former meeting of this Society I read a paper entitled "Infusion of Salt Solution combined with a special method of administering oxygen in pneumonia." This method consisted in passing the oxygen through a wash bottle containing one pint of boiling water in which had been placed one dram of a mixture of creosote, oil of turpentine and compound tincture of benzoinum. In place of the old delivery nozzle, a special funnel was used. The cases reported in that article, with others more recent, proved quite definitely the following: First, oxygen being heated and mixed with steam was more readily absorbed, less drying to throat and tongue, and more agreeable to the patient. Second, passed through a heated inhalation mixture like the above, it certainly had a marked antiseptic effect on the mouth and tongue, evidenced by sweetness of the breath and improved appearance of these parts, no matter how foul at the start. Might it not also have an antiseptic action on the lungs? Third, the pleasant odor of the inhalation mixture gave something tangible for the patients to breathe, who therefore made greater efforts to inhale the oxygen and keep the face under the funnel. This was especially true in children or semi-conscious patients.

Being much impressed by the benefits derived from inhalations of this character in pneumonia, it was decided to give the method a thorough trial in other pulmonary diseases, and this was done with remarkable success in a number of cases. In some of these oxygen being too expensive, compressed air was used, or simply steam alone, while in others I would give the oxygen at my office and have the patients use air or steam at home. The majority were treated in this manner. A few cases, and notably one case of tuberculosis, was treated with oxygen alone, the patient keeping cylinders of this gas at his home. The results in simple acute coryzas and various catarrhal affections of the pharynx and naso-pharynx, grip, acute and chronic bronchitis, etc., were really astonishing.

In a number of cases, purposely, no internal medication was employed, even in quite severe cases of grip, and yet results, when used early, were often about as good as when it was. Several inhalations, sometimes even one, occasionally being sufficient to bring the condition to a termination. I recommend for home use, where a cylinder of oxygen could not be afforded, the "Benzoinal Inhaler" or the "Hynson and Westcott Inhaler," a better modification. This is simply a tin can with an arm and mouthpiece into which one pint of boiling water can be poured. One teaspoonful of the inhalation mixture is then dropped in, the lid clapped on, and the patient breathes in the fumes as they arise from the hot water.

A number of families in this city are never without this little inhaler, which is utilized at the onset of the slightest cold. From a number of cases, three have been selected, with the hope that they might be of interest to the Society, not only from the fact that they were hard cases to benefit, or represented pulmonary conditions of the worst type, but also because they were treated by the inhalation method in different ways, viz:

1st Case. Inhalation mixture and steam alone.
2nd Case. Inhalation mixture, steam and oxygen.
3rd Case. Combined method, inhalation mixture and steam at home; inhalation mixture, steam and oxygen at office.

Case 1.—August 16, 1899. F. M., a barber, aged twenty-two, with chronic purulent bronchitis of several years' standing in spite of various treatments. On examination, this patient showed considerable emaciation, had a hacking cough, with much mucopurulent expectoration, containing numbers of pus and other organisms. The chest, which was long and narrow with limited expansion, contained numerous medium-sized moist râles and some piping and sibilant râles.

Treatment.—Simple iron tonic, inhalations three times a day of the inhalation mixture from a Benzoinal Inhaler, respiratory calisthenics and general gymnastic work. Result: rapid disappearance of sputum and organisms therein. In three months the patient was practically well. He has gone through a very changeable and trying winter without a cold, something which was never done before while suffering from his bronchial affection. At the time this was written, the patient has gained about ten pounds, and feels and looks like a different man.

Case 2.—October 30, 1899. Mr. B. L., merchant, aged 59, with pulmonary tuberculosis. This patient gave a history of a chronic bronchitis of about twelve years' duration, with more acute symptoms the last year. On examination he was fairly well nourished, but pale and ill-looking. The chest was well shaped, but with limited expansion. There was decided flatness over the right infrascapular region, in which a number of gurgling, sibilant liquid râles were heard. These râles were also present at the apex and front. Down in the left subscapular region and around in the axilla a considerable number of dry crepitant râles were found. The patient had a hacking cough, especially in the morning, after which he raised a considerable amount of greenish-yellow purulent sputum. This contained numbers of pus organisms and a considerable number of tubercle bacilli. At time of first visit his temperature was only slightly febrile, but it had been much higher. The case was evidently one of tubercular consolidation in the upper right lobe just beginning to soften and break down.

Treatment.—Inhalations twice a day of oxygen passed

[1] Read before the Medical Society of The Johns Hopkins Hospital, Feb. 5, 1900.

through the steam inhalation, with regular breathing exercises and calisthenics. Creosote was given internally in two-minim doses and cod-liver oil. I will omit a detailed description of the improvement in this case, which was most striking from the very onset. The sputum rapidly grew less in amount, with disappearance of the pus organisms. The patient began to gain weight and noticed especially his increased energy. On February 5, after three months of treatment, the tubercle bacilli had entirely disappeared from the sputum, which was very scant. The gain in weight was over seven pounds, and the patient said he had not felt as well for years. An examination of the chest showed no râles, and but for slight evidences of consolidation was negative. The softening process had evidently ceased, and that of repair seemed to have succeeded. Since this time the patient has continued to improve, and now weighs 163 pounds, a gain of about 12 pounds since treatment was begun. He has had only one cold during the winter, which was readily thrown off, a most unusual event for him.

CASE 3.—The last case to be reported is one of great interest to me, representing, as it does, a rare pulmonary disorder, chronic infantile putrid bronchitis, and also because the little patient came all the way from Havana, Cuba, especially for this treatment. Her father, a man of considerable means, had spared nothing in his efforts to have his daughter cured, and had taken her on different occasions to the mountains of Cuba and Mexico, and also to this country (New York), for medical advice and treatment. The patient, Miss G. R., now aged thirteen, has kindly consented to be presented to the Society, and it can be seen at once she does not look much like an invalid. When one and a half years old an attack of severe bronchitis was followed by a gradual dilatation of the smaller bronchi of the lungs, a condition which was recognized by Dr. Pirez Miro, of Cuba. As the child grew up, this dilated condition of the bronchi became somewhat less marked, but was aggravated by an attack of pneumonia a few years later. She was never without a cough, suffered from severe asthma-like attacks at night, coughed up large amounts of very offensive sputum, with occasional yellow or blackish balls; *i. e.*, probably Dittrich's plugs. The child developed very slowly, had an almost continual fever, and for months at a time her life was despaired of. The mountain air in this case seemed to aggravate rather than relieve the conditions. In fact, while in the mountains of Mexico, she had the attack of pneumonia mentioned above, and could barely be moved home. When I first saw the case, June 3, 1899, examination showed a very small, thin girl, quiet and subdued in manner, weight only 54 pounds, with a cold, clammy skin, temperature 101° to 103°, tongue coated and breath very offensive. She had a continual hacking cough, with expectoration of much mucopurulent sputum of a greenish-yellow color, with considerable amount of frothy, lighter colored material. This sputum contained almost every kind of organism except the tubercle bacilli. There were chains of streptococci and bacilli, with abundant pus. The chest was narrow, ribs and clavicles very prominent. Expansion limited throughout. The note on percussion rather hyperresonant over both lungs. On auscultation the chest was a virtual music-box. Sibilant, piping râles, harsh mucous râles, amphoric sounds, etc., were heard everywhere.

Treatment.—The treatment in this case consisted of inhalations of steam and inhalation mixture three times a day at home. Oxygen, steam and inhalation mixture two to three times a week at my office. Later, when the fever was less, breathing exercises and calisthenics were employed. Purposely no cod-liver oil or expectorants were used, as they had been tried so thoroughly in Cuba, and the only medicine taken was pepto-manganate of iron three times a day with alcohol sponges at night. The result, a rapid improvement, in a few weeks; cough and expectoration was much less, and almost free from bacteria; the breath was sweet and tongue clean; temperature slightly febrile; about three to four pounds gain in weight. In five months' time patient had *no expectoration*, and *weighed 82 pounds, a gain of 28 pounds;* she could run and play with other children and showed rapid development in every way. The fever had entirely disappeared. At the present time she weighs 87 pounds, and but for an occasional cough, more from habit and increased when excited, she is absolutely well. The chest, with the exception of a few dry, crepitant râles, due in great part to thickening of the pleura, is clear and shows an increase in girth of four inches, with a much greater degree of expansion. I have now begun to use cod-liver oil and creosote internally to see whether any additional benefit can be obtained. Since this was written the patient has had a severe attack of measles—which is generally so disastrous to those with any bronchial affection—without having in the least lost ground.

CONCLUSION.

The great quantity and variety of medicines taken internally for acute coryzas, bronchitis, grip, are appalling to the conscientious physician. In addition, numbers of compound remedies with very elaborate titles are daily prescribed for these conditions, some of the ingredients of which, or at least their dosage, too often escaping the memories of those using them. Inhalation methods are the rational means for combating pulmonary affections. Internal medication should be used as an accessory treatment, as for instance, a sedative mixture to relieve excessive coughing, etc. I do not consider diet in this category. Change of climate, mountain air, etc.—in reality inhalation treatments—are all very well for those who can afford them, but what can be done for the masses to whom this is an impossibility? Because many have found inhalations of various kinds of little value in tuberculosis, there is yet no reason to suppose the best treatment will not be found along these lines. I regret that only one case is at hand to demonstrate the utility of this method in that disease. The good effects of oxygen in pulmonary disorders are raised to a maximum when combined with the heated vapors of my inhalation mixture. This mixture has never yet proved irritating or dangerous to the healthy lungs, although possessing

such marked antiseptic properties. At the start a formula: Creosote (Beechwood), Olei Terebinthinæ ā ā drams IV, Tr. Benzoini Co., oz. III, is used (one dram of this mixture being placed in a pint of hot water). As the patient becomes more accustomed to the fumes, *i. e.* does not cough or choke during inhalation, gradually more of the creosote and oil of turpentine is added till a mixture of equal parts of each is obtained: Creosote (Beechwood), Olei Terebinthinæ, Tr. Benzoini Co., ā ā, oz. I.

Inhalations to be effective should be systematic and of sufficient duration, ten to fifteen minutes at least. An indispensable adjunct are breathing exercises and general gymnastic work. No physician can hope to have success in pulmonary diseases unless he makes a thorough study of chest development, calisthenics, and other forms of exercise. In fact, it is necessary that he have a love for this kind of work himself, and by personal example try to awaken in his patients —who, as a rule, are phlegmatic or indifferent—the enthusiasm so important in this kind of work. The excellent work by Dr. Dennison, of Denver, entitled "Exercise and Food in Pulmonary Disorders" has demonstrated the great advantages of such exercises.

The bacteriological examination made of the sputum in a number of my cases proves the marked antiseptic effect of the above inhalation mixtures, especially on the pus cocci. Now, even if, as many authorities have shown, tubercle bacilli, being walled off, are protected from all inhalation vapors, when the severe symptoms so often due to secondary infection are eliminated and other portions of the lungs exercised and disinfected, beyond question a better chance is given to resist the spread of the morbid condition and to wall off completely the tuberculous area.

In addition, some persons will use an inhalation who could never be induced to take breathing exercises. The act of inhaling is, however, a very efficient exercise as any one can easily prove.

Inhalations rarely upset the stomach like cough syrups, etc., and eliminate much of the fatiguing routine of hourly medication. Children will inhale—smoke, as they often call it—willingly if a little diplomacy is used, where they often require force and much coaxing to take medicine.

The science of medicine has advanced beyond the point where we look to it merely for cures. The twentieth century brings with it more appeals than ever for instruction in the prevention of diseases, and especially of those of the respiratory apparatus. If we teach the tailor how to avoid a crooked back, the factory girl how to expand her lungs and utilize what fresh air she occasionally gets; if we place in the hand of the masses a simple method of avoiding colds, etc., we will find our clinics smaller, but our humanity larger.

OBITUARY: JESSE WILLIAM LAZEAR.[1]

Mr. President and Gentlemen:

Before we proceed with the programme this evening, I should like to say a few words about our dear friend Lazear, whose sad death at Quemados, Cuba, on September 25, is so fresh in our minds. Lazear was born just outside of Baltimore thirty-four years ago. He graduated at the Academic Department of the Johns Hopkins University in 1889, and three years later obtained the degree of M. D. from Columbia University, New York. After this he was an interne in the Bellevue Hospital for two years. After spending the greater part of the year in studying abroad, particularly in Paris, he returned in 1895 and became one of the medical staff of the Johns Hopkins Hospital. In the summer of 1896, Dr. Lazear was married and began the practice of medicine in Baltimore. At the same time, however, he was an assistant in clinical microscopy in the University, and in the laryngological department in the Hospital dispensary. Last winter he obtained an appointment as assistant surgeon in the army with special laboratory duties, and was stationed in Havana. There he soon became interested in the study of yellow fever, and for several months he had been one of the commission appointed by the Surgeon-General, for the study of this disease. He had been constantly exposed to infection, and finally, in the course of his duty, contracted his fatal illness.

Dr. Lazear was a man of few words but keen perception. He was an extremely careful and thorough worker. He kept his own counsel, asked few questions and little help of his associates, but he was a man who, when he started an undertaking, had the ability and enthusiasm to keep quietly at work until he accomplished his end. It was through his excellent work that we were able several years ago to make our first positive *intra vitam* diagnosis of septicæmia due to the diplococcus of Neisser. His valuable studies upon the internal structure of the malarial parasite, which I had the pleasure of bringing before this society last winter, are remembered by all.

Personally, he was an exceptionally simple, high-minded and lovable man. He could not have failed to find in a short time a public position in which his unusual merits would have become more generally known.

I should like to suggest to the Society the adoption of the following resolutions:

"*Whereas*, On the 26th day of September, our beloved colleague and friend, Jesse William Lazear, lost his life in the discharge of his duty as a member of the United States Yellow Fever Commission;

"*And whereas*, His exceptional ability in his profession, his

[1] Remarks made by Dr. W. S. Thayer, at the meeting of The Johns Hopkins Hospital Medical Society, Oct. 16, 1900.

simplicity and modesty as a man, had greatly endeared him to all whose good fortune it was to know him;

"*Be it resolved*, That we, his former colleagues and associates, do hereby express our profound sorrow at the loss, to the community of one whose future was unusually rich in promise, to ourselves, of a dear friend and fellow student;

"*And be it further resolved*, That we express to his wife and family our warmest and most heartfelt sympathy."

The resolutions were unanimously adopted.

NOTES ON NEW BOOKS.

Diseases of the Nose and Throat. By J. PRICE BROWN, M. B., L. R., C. P. E., Member of the College of Physicians, Ontario, etc. Illustrated with 159 engravings, including 6 full-page color plates and 9 color cuts in the text, many of them original. (*Philadelphia, New York, Chicago: The F. A. Davis Company, Publishers, 1900.*)

This volume, although rather too condensed for the specialist, can be heartily endorsed as a guide to the general practitioner in the diagnosis and treatment of such laryngological and rhinological cases as may come under his observation.

One is particularly impressed with its readability, the style being extremely fluent. The treatment, especially of the more prevalent conditions, is taken up in a simple and logical manner, which is easy to comprehend.

The chapter on examination is especially to be commended; and it is interesting to note that the author devotes considerable space (Chapter 63) to the description of Autoscopy, introduced by A. Kirstein, of Berlin, and brought forward in this country by Max Thorner, of Cincinnati, and discusses (Chapter 83) the uses of the Roentgen ray in laryngeal surgery.

General practitioners are in great need of books written especially for them by competent specialists. Doctor Price Brown's book will meet this demand in laryngology most satisfactorily.

C. A. PENROSE.

A Text-Book of Diseases of the Nose and Throat. By D. BRADEN KYLE, M. D., Clinical Professor of Laryngology and Rhinology, Jefferson Medical College, etc. With 175 illustrations, 23 of them in colors. (*Philadelphia: W. B. Saunders, 925 Walnut Street, 1899.*)

This book of 650 pages presents many points of interest. The classification of the various conditions from a pathological standpoint is very satisfactory, although there is much need of further work in the pathology of diseases of the nose and throat. The illustrations are, for the most part, original and appropriate. The details of treatment are fully entered into and are up to date.

In Chapter III, the use of the term catarrh is very properly deplored as indicating any definite disease. It is indeed better to use the adjective catarrhal in connection with special forms of inflammation.

In Chapter VIII, the nasal neuroses are thoroughly discussed with special reference to their etiology. Considerable weight is given to the effects of the pollen of plants as the exciting agent in many cases of hay fever. The author believes the term Hyperesthetic Rhinitis to be the most appropriate one for this condition.

The various neoplasms of the respiratory tract are taken up (Chapter XI) in great detail with especial reference to their pathology and are carefully classified. In Chapter XXIII, the advantage of a preliminary tracheotomy in most operations on the larynx is denied, and a very suggestive method outlined for a complete laryngectomy with the patient in the "Trendelenburg" position, which is maintained for three days after the operation.

In order to attain completeness and to render reference less arduous, as stated in the preface, considerable repetition has been necessary, but this is by no means a fault, and adds much to the clearness of the book.

The author has unquestionably given to the medical profession a work of great merit—the result of much labor and careful thought, and one which will be of great service to every one desiring to be proficient in this specialty.

C. A. PENROSE.

The Pathology and Surgical Treatment of Tumors. By N. SENN, M. D., Ph. D., LL. D. Second Edition, revised. Illustrated by 478 engravings and 12 full-page plates in colors. (*Philadelphia: W. B. Saunders, 1900.*)

This new edition of a valuable work is welcomed by all who knew the worth of the former. The book is useful to both surgeon and pathologist, dealing thoroughly and conscientiously with all forms of tumors and presenting recent facts concerning them. The arrangement of material is practical, and insures an interesting recapitulation of the most important details of each subject considered.

The first twelve chapters, dealing with the origin, etiology, biology, pathology, clinical aspects, diagnosis, prognosis, treatment and classification of tumors, are the most interesting. They present a full scientific and practical review of much of the best and most interesting material which falls to the pathologist to study.

A short chapter on tumors in plants and animals, with references to the work on the parasitic origin of tumors, makes a very interesting *résumé* of our knowledge in this most actively worked field. Senn classifies tumors according to the embryonic tissue in which they develop, and adds a chapter on retention cysts, or swellings caused by the retention of physiological secretions. These cysts, he claims, cannot well be differentiated from tumors.

Senn properly states that we have not approached any nearer the solution of the question of the causation of tumors than the older masters. One expression repeated often in his book cannot be too deeply impressed on a student's mind, namely, that the tumor arises from a matrix of embryonic cells misplaced either in embryonic or in the post-natal life. In discussing the influence of the surrounding tissues on tumor growth, he ascribes to them a negative influence. There is, however, a growing tendency to assign a more active part to the tissues in which the tumor grows. Senn rejects the theory of the microbic origin of tumors. He would place them among the granulomata, if an infective cause were proven.

In describing special tumors, he gives their counterparts in the normal tissues of the body, and treats of them systematically under the following headings: Description, Histology and Pathology, Etiology, Transformations, Topography, Diagnosis, Prognosis, and Treatment. His chapter on Diagnosis is clearly and thoroughly written from the pathological and clinical standpoint, and most systematically arranged. It is of interest to note that he considers the microscope overrated as an aid to diagnosis.

Conservative and radical measures for the treatment of tumors are equally described; and where a radical operation is advised, it is described in detail.

The volume is well illustrated and printed, and is an authority in the medical world.

Essentials of Diagnosis; arranged in the form of Questions and Answers. Prepared especially for Students of Medicine. By SOLOMON SOLIS-COHEN, M. D., and AUGUSTUS A. ESHNER, M. D. Illustrated. Second Edition, revised and enlarged. (*Philadelphia: W. B. Saunders, 1900.*)

This second edition of a deservedly popular hand-book of medical diagnosis has been thoroughly revised and considerably enlarged. The definitions are sometimes too much compressed to be clear, and the book generally may be said to suffer from an attempt to compress it into a narrow space. It contains an occasional personal observation, but for the most part the book is a compilation from other text-books. The work is methodically and painstakingly done, and the authors deserve much praise for their labor. It can but assist those persons who wish to renew their acquaintance with the science of medicine.

University of Pennsylvania. Contributions from the William Pepper Laboratory of Clinical Medicine. (*Philadelphia: Published on the Phœbe A. Hearst Foundation, 1900.*)

This volume of 479 pages contains thirteen original contributions to medical literature, the result of recent investigations conducted in the William Pepper Laboratory of Clinical Medicine. It is published in memory of the late Dr. William Pepper, through whose generosity the laboratory was founded.

There is an excellent photogravure of Dr. William Pepper. The style of the volume is pleasing to the eye. The paper and printing are excellent. The colored plates and the cuts in the text are fairly good.

It is impossible to attempt a digest of the various articles in a review of this kind, and while it would be an injustice to particularize, we think that some of the contributions deserve special mention. Dr. William Spiller reports two cases of muscular dystrophy with the gross and microscopic findings at autopsy. In another contribution he reports a case of amyotrophic lateral sclerosis in which degeneration was traced from the cerebral cortex to the muscles. The most elaborate report is by Dr. Alonzo E. Taylor. It comprises 180 pages, and in it he gives the result of his "Studies in Leukæmia," which are based on the study of sixteen cases. We had hoped to find some mention of Löwits's parasitic theory of the causation of both lymphatic and myelogenous leukæmia. We regret that Dr. Taylor has not studied the blood from this standpoint, because Löwits's views have yet to be confirmed, and they have recently been severely attacked by Türk, of Vienna. Dr. Stengel has an interesting contribution on the pathology of the erythrocyte. The other papers, although shorter, are fully as deserving of mention. There is also a list of the previous contributions from the laboratory.

The volume does full justice to the object it was intended to serve, and we take great pleasure in congratulating Dr. Stengel, the director of the laboratory. If we were to offer any criticism, we would point to the rather large number of papers in this volume and in the list of previous contributions which deal with the pathological side of medicine and which would seem more in place in the reports from a pathological laboratory than from a laboratory of clinical medicine.

Surgical Anæsthesia, Addresses and Other Papers. By HENRY JACOB BIGELOW, A. M., M. D., LL. D. (*Boston: Little, Brown & Company.*)

The first part of this volume of 378 pages contains a series of papers, arranged in chronological order, dealing with the discovery of surgical anæsthesia. The majority of the papers have been published in various medical journals, particularly the Boston Medical and Surgical Journal, but a few appear here for the first time. Those interested in the question of the priority of the discovery of anæsthesia will find these papers particularly instructive, and the medical profession generally will find them entertaining reading.

The papers were written between the years 1846 and 1876. Throughout, Dr. Bigelow is an ardent supporter of Dr. Morton, whom he considers the discoverer of ether anæsthesia. Dr. Bigelow was a contemporary of Dr. Morton and was perfectly familiar with the facts concerning the discovery from the first. It was Dr. Bigelow who first publicly announced Morton's great discovery. The first time ether was used to relieve sensibility to pain in a surgical operation was on October 16, 1846. The anæsthetic was given by Dr. Morton and the operation was performed by Dr. Warren. Morton had previously used the drug in his dental practice in the extraction of teeth.

Dr. Bigelow strongly defends Morton against all others who attempted to claim priority in the use of ether as an anæsthetic, as well as against those who at first endeavored to belittle the importance of the discovery. Apparently Dr. Bigelow was not familiar with the claims of Dr. Crawford W. Long, of Jefferson, Georgia, to priority in the discovery of the anæsthetic effects of ether, as his name does not appear anywhere in the controversy. Many claim that to Long belongs the credit of the discovery. Long operated on his first case under ether on March 30, 1842, practically four and a half years previous to Morton and Warren's first case, and there are records of his having operated on eight cases previous to the date of Warren's operation. Unfortunately for Long, he did not publish his cases until after 1846. Dr. Bigelow would probably have answered Long's contention as he did that of others as follows:

"Many may have been the real discoverers of ether insensibility to pain, and at a remote period. But if so, they have kept it to themselves; and they will be known as discoverers only to themselves. The world has always honored that individual among such discoverers who presented his discovery to them. Dr. Morton was, according to the evidence in print, both the prime mover and the immediate agent in the introduction of this discovery to the world."

There is considerable repetition in these articles on anæsthesia, but the fact that they were contributed at various intervals during three decades merely serves to impress us with Dr. Bigelow's great readiness, as occasion arose, to do honor to Morton and his great discovery.

The second part of the volume contains a number of interesting addresses on general medical subjects. The most important of these are: "Fragments of Medical Science and Art"; "Science and Success"; "Medical Education in America." These impress one with Dr. Bigelow's clear style of writing and with his wonderful fund of general information. In the latter address, written in 1871, he comes out rather strongly on the side of the anti-vivisectionists, particularly against vivisection which occasions any degree of pain to the animals experimented upon. His views are further given in two heretofore unpublished letters on the question of vivisection.

Medical and Surgical Report of the Presbyterian Hospital in the City of New York. Vol. IV, January, 1900. Edited by Andrew J. McCosh, M. D., and W. Gilman Thompson, M. D. (*New York: Trow Directory Printing and Publishing Company.*)

It is difficult to do justice to all contributors to a volume of this kind, comprising, as this one does, twenty-two separate papers. The volume contains 223 pages. The articles are contributed by various physicians, surgeons and pathologists connected with the Presbyterian Hospital in New York.

The volume opens with a paper by F. Tilden Brown on the Surgical Treatment of Ascites due to Cirrhosis of the Liver. The object of the operation is to favor the establishment of compensatory anastamoses between the portal and general

venous system. The following papers deserve mention as being of special interest: "Remarks on the Surgery of the Biliary Passages with a Report of Ten Choledochotomies," by Andrew J. McCosh, M. D.; "Typhoid Fever in an Infant Nine Months Old—Recovery," by W. P. Northrop, M. D.; "Report of Ten Cases of Subphrenic Abscess," by Forbes Hawkes, M. D.; "A Report of Twenty-eight Cases of Suppurating Hepatitis," by Stuart Hart, M. D.; and "Statistics of One Hundred Cases of Cancer of the Breast and the results of Operation," by Clarence A. Williams, M. D.

Sajous's Annual and Analytical Cyclopædia of Practical Medicine. Volume V. (*Philadelphia, New York, Chicago: The F. A. Davis Company, Publishers.*)

The high standard of its predecessors is maintained in this volume. It covers the subjects from "Methyl-blue" to "Rabies" inclusive, and contains 662 pages. The editor refers, in the preface, to the loss which he and the profession generally have sustained in the death of two of the associate editors since the publication of the last volume, viz., Dr. Norman Kerr, of London, and Dr. J. E. Graham, of Toronto. This volume embraces nearly all of the specialties—otology, laryngology, ophthalmology, neurology, pediatrics, obstetrics and therapeutics.

The late Dr. Kerr has given us the advantage of his experience in elaborating the excellent article on Morphinomania contributed by the editor. Of special interest to those who have the care of infants in their charge is the article entitled "Nursing and Artificial Feeding," written by Dr. Holt and Dr. Fétra, of New York. Some of the most important diseases of the lungs are included in this volume. Pleurisy and various affections involving the pleural cavities are treated thoroughly and concisely by Dr. McPhedran, of Toronto. The instructive articles on "Catarrhal Pneumonia" and "Lobar Pneumonia" are respectively written by Dr. Solomon Solis-Cohen and Dr. Thomas G. Ashton, of Philadelphia. The specialties have had full justice done them by the various contributors, and the practicing physician will obtain useful aid in the treatment of affections of the eye, ear and throat.

Short Papers on Nursing Subjects. By L. L. DOCK. (*New York: M. Louise Longeway, Publisher, 1900.*)

This modest little pamphlet of 57 pages contains four short sketches which are of peculiar interest to nurses. "A Pilgrimage to Kaiserswerth" gives an interesting account of a visit to the scene of the labors of Pastor Fliedner, with a description of the present condition of the old mother-house. The tale is attractively told and is interesting to all, whether nurses or otherwise.

"Nursing Organizations in Germany and England" presents very clearly the differences which exist between English and German methods of nursing. In Germany everything is arranged according to law, and little scope exists for individual or independent action. In England there is more freedom and greater flexibility in the organization of nursing. The writer's personality is displayed in her references to the English pension fund, which seems to her to be the sum of all abominations instead of a benevolent scheme to help improvident nurses to put by something for old age.

"The Nurses' Settlement in New York" is an extremely interesting and readable account of philanthropic effort. It fails to give a very definite notion of what is actually accomplished by this and similar settlements. It is hardly worth while for nurses to live among the poor just for the sake of living among them or in order to show that they can so live surrounded by similar discomforts. If the life of a nurse in the slums tends to relieve the condition of the poor or to make their lot one whit less hard, there would seem to be some good grounds for such acts of self-renunciation on the part of nurses. If, however, life in the slums is merely to demonstrate that nurses can live among the poor, the outcome would seem to be wholly incommensurate with the output of effort and self-sacrifice.

The booklet represents the views of a very earnest and faithful worker in training-schools, among nurses and among the poor, and deserves to be read by all who are interested in the work of nurses.

Embryochemical Studies. By P. A. LEVENE. (*Archives of Neurology and Psychopathology*, II (1899), p. 557.)

The article gives an account of the first of a series of researches which will have for their object the study of the changes in the chemical distribution of nitrogen and phosphorus in the fertilized egg as development proceeds. The material used was the egg of the codfish, and this was examined in four stages: unfertilized, 24 hours after fertilization, 11 days after fertilization, and 20 days after fertilization. In each case the material was analyzed as follows:

The material was dried at 105°, extracted with very dilute hydrochloric acid and phosphotungstic acid added in excess. The nitrogen of the precipitate and residue was then determined as nitrogen of proteids and bases.

A second portion of the dried material was extracted in turn with boiling alcohol, ether, alcohol, boiling water acidified with acetic acid and cold water, and the nitrogen determined in the residue as nitrogen of total proteids.

A portion of eggs was extracted with cold and hot alcohol, cold and hot ether, and dried at 105°. In a weighed portion of this material the nuclein bases were extracted with sulphuric acid and weighed as silver compounds, while a second portion of the same material was submitted to the prolonged action of pepsin-hydrochloric acid and the undissolved portion weighed as nuclein.

It will be seen that the analytical results thus obtained furnish the data for calculating any changes that occur in the quantities of amido acids, proteids, nuclein bases or nucleoproteids as the development of the egg proceeds. While the author feels that it would be premature to draw any broad conclusions from the data thus far obtained, the results point strongly to the conclusion that in the course of development the processes of synthesis are preceded by those of decomposition. In the first stage after fertilization the proteids diminish in quantity and basic nitrogenous substances are formed at their expense. Later the basic substances decrease in quantity and the proteids increase. The combined proteids (nucleoproteids) and mineral substances greatly increase in the course of growth.

A continuation of this work should bring to light matters that are of interest.

On the Absorption of Proteids. By P. A. LEVENE and I. LEVIN. (*Archives of Neurology and Psychopathology*, II (1899), p. 553.)

While it has been generally conceded that the products of proteid digestion are taken directly from the digestive tract into the blood and thus find their way to the other tissues, the recent work of Asher led him to believe that the prevailing view is based on inconclusive experimental evidence and that the principal path of absorption is the lymphatic system.

In order to test the correctness of Asher's statement, the authors performed a series of experiments upon dogs in which carefully prepared iodoproteid was ingested, thus adopting conditions which permit a clear differentiation of the proteid ingested from the tissue proteids. The ingestions were made variously in the large intestine and colon, in the small intestine and along the entire digestive tract, and the lymph was collected from the thoracic duct from one to seven hours after the ingestion; yet in no instance could iodoproteid be shown in the lymph. The experiments are very conclusive in showing that the lymph is not a path of absorption of the iodoproteids.

The Chemical Relationship of Colloid, Mucoid and Amyloid Substances. By P. A. LEVENE. (*Archives of Neurology and Psychopathology*, II (1899), p. 571.)

The very remarkable work of Schmiedeberg showed that the chondroïtin-sulphuric acid of the cartilage is capable by hydrolysis of producing chondrosin, glycuronic acid and glucosamine; and it has since been found that chrondroïtin-sulphuric acid exists in some form of combination in the amyloid substance—

$$\underset{\text{chondroïtin}}{C_{13}H_{21}NO_{14}} + 3H_2O = \underset{\text{chondrosin}}{C_{12}H_{21}NO_{11}} + 3CH_3.COOH$$

$$\underset{\text{chrondrosin}}{C_{12}H_{21}NO_{11}} + H_2O = \underset{\text{glycuronic acid}}{(CHOH)_4 < \begin{matrix} COOH \\ CHO \end{matrix}} + \underset{\text{glucosamine.}}{C_6H_{11}O_5.NH_2}$$

Levene now finds that tendomucin is a combination of a proteid with a nitrogenous ethereal sulphuric acid very similar to chrondroïtin-sulphuric acid since it yields chrondrosin and that submaxillary mucin, as well as colloid of a colloidal carcinoma, contains very similar or identical ethereal sulphuric acids in combination. The work points very clearly to the conclusion that colloid, mucoid and amyloid substances are similarly constituted.

BOOKS RECEIVED.

Annual and Analytical Cyclopædia of Practical Medicine. By Charles E. de M. Sajous, M. D., and one hundred associate editors, assisted by corresponding editors, collaborators and correspondents. Volume V. 1900. 4to. 662 pages. The F. A. Davis Company, Philadelphia, New York, Chicago.

Clinical Examination of the Urine, and Urinary Diagnosis. A Clinical Guide for the Use of Practitioners and Students of Medicine. By J. Bergen Ogden, M. D. Illustrated. 1900. 8vo. 416 pages. W. B. Saunders & Company, Philadelphia.

A Manual of Personal Hygiene. Edited by Walter L. Pyle, A. M., M. D. Illustrated. 1900. 12mo. 344 pages. W. B. Saunders & Company, Philadelphia.

Atlas and Epitome of Diseases Caused by Accidents. By Dr. Ed. Golebiewski, of Berlin. Authorized translation from the German, with editorial notes and additions by Pearce Bailey, M. D. 40 colored plates and 143 illustrations in black. 1900. 12 mo. 549 pages. (Saunders' Medical Hand-Atlas.) W. B. Saunders & Company, Philadelphia.

Medical and Surgical Report of the Presbyterian Hospital in the City of New York. Volume IV. January, 1900. Edited by Andrew J. McCosh, M. D., and W. Gilman Thompson, M. D. 8vo. xiv + 223 pages. Trow Directory Printing and Bookbinding Company, New York.

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In the methods of instruction especial emphasis is laid upon practical work in the Laboratories and in the Dispensary and Wards of the Hospital. While the aim of the School is primarily to train practitioners of medicine and surgery, it is recognized that the medical art should rest upon a suitable preliminary education and upon thorough training in the medical sciences. The first two years of the course are devoted mainly to practical work, combined with demonstrations, recitations and, when deemed necessary, lectures, in the Laboratories of Anatomy, Physiology Physiological Chemistry, Pharmacology and Toxicology, Pathology and Bacteriology. During the last two years the student is given abundant opportunity for the personal study of cases of disease, his time being spent largely in the Hospital Wards and Dispensary and in the Clinical Laboratories. Especially advantageous for thorough clinical training are the arrangements by which the students, divided into groups, engage in practical work in the Dispensary, and throughout the fourth year serve as clinical clerks and surgical dressers in the wards of the Hospital.

REQUIREMENTS FOR ADMISSION.

As candidates for the degree of Doctor of Medicine the school receives:

1. Those who have satisfactorily completed the Chemical-Biological course which leads to the A. B. degree in this university.

2. Graduates of approved colleges or scientific schools who can furnish evidence: (a) That they have acquaintance with Latin and a good reading knowledge of French and German; (b) That they have such knowledge of physics, chemistry, and biology as is imparted by the regular minor courses given in these subjects in this university.

The phrase "a minor course," as here employed, means a course that requires a year for its completion. In physics, four class-room exercises and three hours a week in the laboratory are required; in chemistry and biology, four class-room exercises and five hours a week in the laboratory in each subject.

3. Those who give evidence by examination that they possess the general education implied by a degree in arts or in science from an approved college or scientific school, and the knowledge of French, German, Latin, physics, chemistry, and biology above indicated.

Applicants for admission will receive blanks to be filled out relating to their previous courses of study.

They are required to furnish certificates from officers of the college or scientific schools where they have studied, as to the courses pursued in physics, chemistry and biology. If such certificates are satisfactory, no examination in these subjects will be required from those who possess a degree in arts or science from an approved college or scientific school.

Candidates who have not received a degree in arts or in science from an approved college or scientific school will be required (1) to pass, at the beginning of the session in October, the matriculation examination for admission to the collegiate department of the Johns Hopkins University, (2) then to pass examinations equivalent to those taken by students completing the Chemical-Biological course which leads to the A. B. degree in this University, and (3) to furnish satisfactory certificates that they have had the requisite laboratory training as specified above. It is expected that only in very rare instances will applicants who do not possess a degree in arts or science be able to meet these requirements for admission.

Hearers and special workers, not candidates for a degree, will be received at the discretion of the Faculty.

ADMISSION TO ADVANCED STANDING.

Applicants for admission to advanced standing must furnish evidence (1) that the foregoing terms of admission as regards preliminary training have been fulfilled, (2) that courses equivalent in kind and amount to those given here, preceding that year of the course for admission to which application is made, have been satisfactorily completed, and (3) must pass examinations at the beginning of the session in October for all the subjects that have been already pursued by the class to which admission is sought. Certificates of standing elsewhere cannot be accepted in place of these examinations.

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